Canadian Agriculture Library
Bibliothèque canadienne de l'agriculture
Ottawa K1A 0C5

Do not remove from
Library / Reading Room
Laisser dans la
bibliothèque / salle de lecture

Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

CANADA AGRICULTURE

WINTER 75
HIVER 75

The modern entrance to the new Animal Diseases Research Institute laboratories in Ottawa reflects new concepts in animal diseases research. See story page 10.

L'entrée principale du nouvel Institut de recherches vétérinaires à Ottawa est aussi moderne dans sa conception que les recherches qui s'y font. Voir texte en page 10.

CANADA AGRICULTURE

PERFORMANCE SELECTED HOGS 3
CORN RESEARCH AND PRODUCTION IN THE MARITIMES 7
ANIMAL DISEASES RESEARCH INSTITUTE (EASTERN) 10
INSTITUT DE RECHERCHES VÉTÉRINAIRES (EST) 10
FEEDING THE WORLD POPULATION 12
WEATHER AND WORLD FOOD SITUATION 15
ECHOES/ÉCHOS 18
THE SHEEP INDUSTRY STEPS FORWARD 20
INCREASING PRODUCTION FROM RANGELAND 24
HOTTER HOSPITAL FARE FROM FROZEN FOODS 26
THE PROTEIN QUALITY OF FABABEAN CULTIVARS 28
A WARNING SYSTEM FOR PESTS IN APPLE ORCHARDS 30
THE EFFECTS OF SEEDING DEPTH ON SPRING WHEAT PRODUCTION 32
DETECTING INSECTS IN GRAIN-FILLED BOXCARS 33

VOLUME 20 WINTER 1975 NO. 1
VOLUME 20 HIVER 1975 N° 1

JOURNAL OF THE CANADA DEPARTMENT OF AGRICULTURE—OTTAWA
REVUE DU MINISTÈRE DE L'AGRICULTURE DU CANADA—OTTAWA

MINISTER, HON. EUGENE WHELAN, MINISTRE DEPUTY MINISTER, S. B. WILLIAMS, SOUS-MINISTRE

CANADA AGRICULTURE is published quarterly to inform extension workers and agribusinessmen of developments in research and other federal agricultural responsibilities.

Any article may be reproduced without special permission provided the source is given credit. If excerpts only are to be used, authors' permission should be obtained.

Reprinted articles must not be associated with advertising material. The use of trade names published in this journal implies no endorsement of the products named nor any criticism of similar products not mentioned.

Contributors may submit articles in either English or French to the Secretary, Editorial Board, Information Division, Canada Department of Agriculture, Ottawa.

La revue trimestrielle *CANADA AGRICULTURE* renseigne les vulgarisateurs et représentants du négoce agricole sur les développements de la recherche et des autres services agricoles du gouvernement fédéral.

La reproduction des articles est permise en indiquant l'origine. Pour reproduire des passages d'un article, l'autorisation de l'auteur est nécessaire.

Les articles reproduits ne doivent pas servir à des fins de réclame. La mention de marques de fabrique ne signifie pas que la revue garantit ces produits ni qu'elle déconseille d'autres produits non mentionnés.

Les articles en anglais ou en français doivent être adressés au secrétaire du Comité de rédaction, Division de l'information, ministère de l'Agriculture du Canada, Ottawa.

EDITORIAL BOARD

COMITÉ DE RÉDACTION

G. M. Carman
Chairman / Président
E. J. LeRoux
C. R. Phillips
A. E. Lewis
J. F. Frank
J. J. McConnell
C. H. Kenney
D. W. MacDonald
Secretary / Secrétaire

Editor-writer / Rédactrice
L. J. James
Editing / Rédaction
D. W. MacDonald
G. J. Lempereur
D. M. Guertin

Graphic Design / Graphique
A. J. McAllister

Agriculture Canada

PERFORMANCE SELECTED HOGS

D. W. MacDONALD and H. GRIEGER

Grâce au contrôle des aptitudes (*R.O.P.*) effectué dans le cadre du Programme d'épreuve des porcs, les producteurs canadiens de porcs peuvent identifier les sujets supérieurs de reproduction et les multiplier en nombre suffisant pour être en mesure de fournir aux producteurs des géniteurs permettant d'accroître la production économique de porcs de marché de qualité.

Canadian pork producers produce from 8 to 10 million hogs a year to meet the demand for quality pork products. They produce market hogs in 5 to 6 months, and produce approximately a pound of pork for every 3 lb of feed consumed. By any standard, this is efficient production by Canadian producers, using up to date technology in feeding and management, combined with the use of quality breeding stock.

Swine specialists indicate that the growth potential of hogs can be improved appreciably through intelligent and systematic selection of performance tested boars. The objective is, therefore, to identify the superior breeding animals, and multiply them in sufficient numbers to supply producers with breeding stock that will significantly influence the economic production of quality market hogs.

This is where R.O.P. (Record of Performance) comes in. Swine testing in Canada actually started in 1928 with the inauguration of the Advanced Registry Policy for Pure Bred Swine and the appointment of the Advanced Registry Board as an advisory body to the Department of Agriculture.

Since the introduced swine testing policy received very encouraging support from swine breeders in every province of Canada, the Advanced Registry Board proceeded with the establishment of qualifying standards as well as regulations governing the policy which were accepted and approved by the Department of Agriculture.

The fact was recognized, if pigs were to be compared at the national level, they had to be tested under similar conditions and management. As a result, the Canada Department of Agriculture in 1935 initiated the construction of test stations across Canada for the testing of pure bred pigs.

Today there are eight test stations across Canada, with every province in Canada having access to a swine test station under the management and supervision of the Livestock Division, Agriculture Canada.

Mr. MacDonald is with the Information Division, and Mr. Grieger is with the Livestock Division, Agriculture Canada, Ottawa.

A new ROP test station for swine was opened last year by the Livestock Division, Agriculture Canada, near New Dundee, Ont.

The present National R.O.P. for Swine Testing Program is jointly administered in each province by the federal and provincial departments of agriculture.

The broad objectives of the R.O.P. Program are as follows

- To provide a program which enables the seed stock industry to develop and supply the commercial swine industry with an input of breeding stock that is fully competitive with stock from other swine producing countries.
- Develop a testing and evaluation program which provides optimum opportunity for selection.
- Encourage and assist breeders in designing a breeding program which will permit effective within herd genetic improvement, adequate to meet industry needs.
- To produce an industry structure which will result in the production of genetically superior stock on an adequate scale such that it can be dispersed throughout the industry with a resultant significant improvement in the overall superiority of the final product.

Boar Performance

The emphasis in swine testing today is on boar performance testing at all R.O.P. Stations and therefore receives first priority.

The Swine Testing Program is divided into two parts—Station Testing and Home Herd Testing

Station Testing (1) Boar Performance Test—Where an individual boar is tested to find its comparative merit. The test commences when a group of boars (two to four) reach the approximte average weight of 65 lb and concludes at the approximate average weight of 200 lb.

The Performance Test for Boars assesses the following traits:

- Average daily gain on test
- Age adjusted to 200 lb live weight
- Backfat thickness measured ultrasonically and adjusted to 200 lb live weight.
- Estimated loin eye area based on a single ultrasonic loin muscle depth measurement taken at the last rib and approximately 5 cm off the midline.
- Feed consumed per 100 lb live gain.

Boars have to meet a required performance standard (determined by the Provincial R.O.P. Swine Committees), be of good type and free of physical defects.

Boars not meeting these requirements are castrated and slaughtered.

(2) Sire Progeny Test

(a) Eight market pigs (castrated males or females) are nominated, two from each of four dams with all from the one sire.

(b) These pigs commence test after reaching approximately 65 lb and are slaughtered at 200 lb live weight.

(c) The traits assessed are as follows:

- Adjusted age to slaughter
- Feed consumed per 100 lb live gain
- Length of carcass side
- Total fat
- Area of loin
- Percentage ham of side

Ultrasonic devices give a measure of meatiness or carcass quality of breeding stock, without slaughtering the animal.

Boars showing low rate of gain in ROP weight tests can be culled.

- Lean area over ham weight
- Percentage yield of trimmed cuts

All measurements are corrected for sex and weight.

Home Herd Testing Testing of breeding animals (boars and gilts) is conducted on the farm premises. This program is jointly administered by the federal and provincial departments of agriculture. Breeders are visited on a regular basis by a swine technician where boars and gilts are weighed and ultrasonically measured for backfat thickness and estimated loin eye area.

Weigh and Probe

All potential breeding stock must be submitted by the participating breeder for weight and probing. The program is standardized across Canada and every province is participating.

The traits evaluated are:

- Adjusted age to 200 lb live weight
- Estimated loin eye area
- Adjusted backfat to 200 lb live weight.

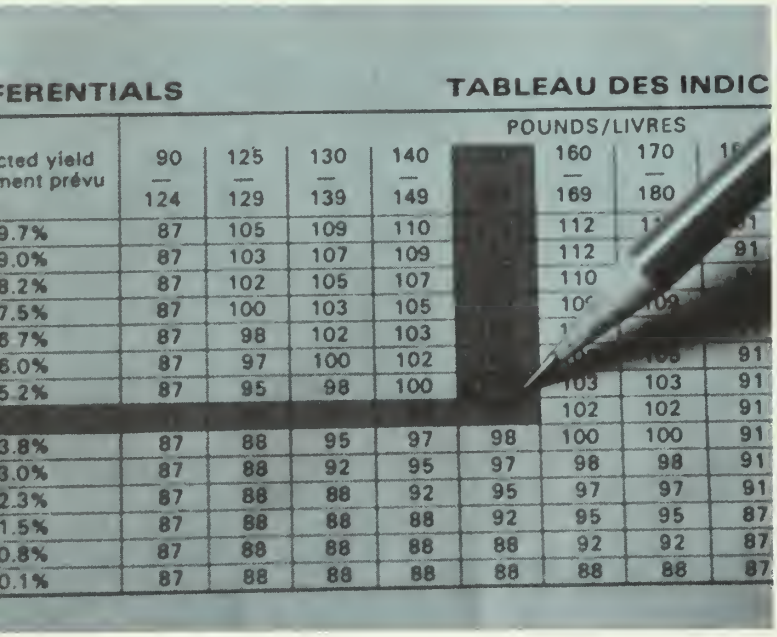
Further to this, Agriculture Canada is providing the breeders with a quarterly herd summary report which provides the breeder with the following test data and averages:

- Listing of all animals weighed and ultrasonically probed by litter and breed.
- Averages by litter for all animals weighed and probed by sire and dam and by breed.
- Updated sire averages by breed, listing the number of progenies tested and their averages.
- Herd averages of all animals tested during the 3 month period.
- Provincial averages
- National averages

The 8 to 10 million hogs marketed each year in Canada are produced on about 120,000 farms in Canada. On the basis of two boars per herd, the number of boars required to produce the above number of market hogs is approximtely 60,000.

The annual boar requirement for the national herd (60,000 to 80,000 boars) is presently supplied by a variety of sources:

- pedigreed boars from members of breed associations
- non-pedigreed straightbred boars from members of breed associations.
- non-pedigreed straightbred boars from herds that have ceased to maintain registration status for their purebred sow herds.
- non-pedigreed straightbred boars from the foundation stocks maintained by breeding companies.
- crossbred and/or grade boars produced in herds both within and without the membership of breed associations
- boars produced in commercial herds and used within those herds or sold (through auction marts) for breeding.



FERENTIALS — TABLEAU DES INDIC

cted yield nent prévu	POUNDS/LIVRES 90 — 124	125 — 129	130 — 139	140 — 149		160 — 169	170 — 180	
9.7%	87	105	109	110		112		
9.0%	87	103	107	109		112		91
8.2%	87	102	105	107		110		
7.5%	87	100	103	105		10		
6.7%	87	98	102	103				
6.0%	87	97	100	102				91
5.2%	87	95	98	100		103	103	91
						102	102	91
3.8%	87	88	95	97	98	100	100	91
3.0%	87	88	92	95	97	98	98	91
2.3%	87	88	88	92	95	97	97	91
1.5%	87	88	88	88	92	95	95	87
0.8%	87	88	88	88	88	92	92	87
0.1%	87	88	88	88	88	88	88	87

Breeders who use boars with low backfat measurements can produce hogs that grade above index 100 (the national average) which will return more dollars per pound.

There's a need to test the performance of all likely boars in the hog population to cull those of poor potential.

In 1973, 1,603 boars completed a successful test at the test stations across Canada and about 8,000 boars were tested under the home herd test program.

The conclusion is that the seed stock industry has considerable opportunity for expansion with performance tested stock.

Presently, breeding stock is supplied mainly by the purebred swine industry and to some degree by breeding companies. The purebred industry, as the service industry to the commercial sector, must recognize and capitalize on the development of an effective combination. One of its foremost needs as it does this is a sound breeding-selection program based on performance records.

Everyone's Program

Some breeders have made the remark that the R.O.P. Program is a government program and in turn some commercial producers have said R.O.P. is designed for the purebred breeders only. It is believed that the Swine Industry must get all groups involved to agree that R.O.P. is everyone's program and all will benefit from the improvements made in quality pork production.

Basic to the development of a stronger R.O.P. program is the need for strong consistent leadership and a stronger communications structure among Canadian swine breeders. The breeders themselves must assume the responsibility to strengthen their breed organization by encouraging more seed stock producers to join their organization, to test pigs, and to use the test results for selection in their herds. In other words, the breed organizations need to develop a unity of purpose which recognizes the importance of identifying superior animals through R.O.P. and supports programs designed to optimize the use of superior tested individuals in members herds.

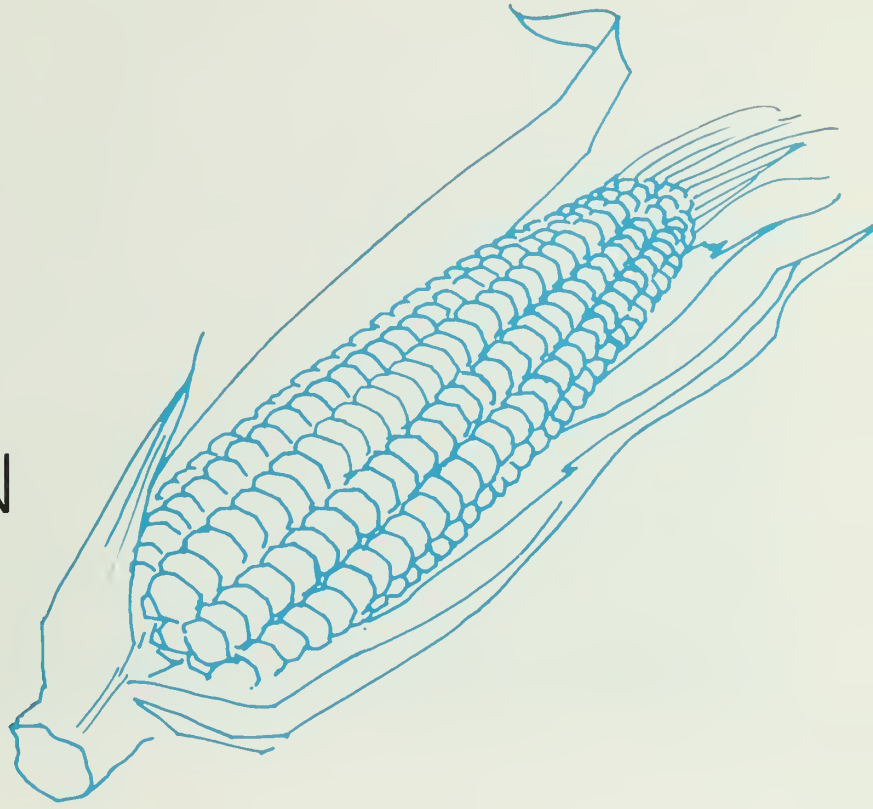
Breed associations might find ways to encourage the effective application of test results through incorporating R.O.P. test results as a requirement for registration.

Above all perhaps, breeders must accept the basic principle that consistent performance selection is the essential element in genetic improvement. With the test stations operating at full capacity, priority for test station space should be given to breeders who are prepared to comply with the principles of complete herd testing and selection within the herd based on test information.

R.O.P. can give breeders the comparative information they need for more intelligent selection.

The R.O.P. for Swine Advisory Board feels it has devised the elements of a good testing system. Efforts will now be directed to develop a structure within the swine industry that will identify an increasing number of performance tested and genetically superior boars from a top percentage of the boars tested nationally. ■

CORN RESEARCH AND PRODUCTION IN THE MARITIMES



J. E. LANGILLE and G. G. SMELTZER

Les chercheurs scientifiques d'Agriculture Canada et les vulgarisateurs provinciaux étudient les populations de plantes, les hybrides, les dates de semis, la lutte contre les mauvaises herbes, les dates de récolte, les méthodes de plantation et la fertilité du maïs afin d'en augmenter la production dans les Maritimes. On recherche un maïs de 2200 à 2300 unités afin de faire la concurrence aux céréales de cette région.

Corn research in the Maritimes, prior to 1965, was carried out on a provincial basis with Agriculture Canada research establishments at Kentville, Nappan, Fredericton and Charlottetown having the main input. In that year, a committee of federal and provincial specialists was formed. Subsequently, it became a part of the Atlantic Field Crops Committee. G. G. Smeltzer was appointed coordinator for breeding assessment of hybrids for the region. At that time, hybrid evaluations, plant population studies, dates of seeding, weed control, seed treatment, soil insects, depth of planting and fertility studies were in progress. Since then, Agriculture Canada research workers and provincial soils and crops specialists have worked closely in trying to solve the many problems related to corn production.

Mr. Langille is a cereal and forage crops specialist at the CDA Experimental Farm. Nappan, N.S. Mr. Smeltzer is coordinator for corn breeding assessment, CDA Research Station, Kentville, N.S.

In 1964, fertility trials with corn were begun on six soil series in Nova Scotia at 14 locations and carried out over a 6-year period. Results indicated that factors other than nutrient supply also affected yield, but that N, P. and K at 90-135, 28-40 and 28-36 lb/ac, respectively, were generally adequate.

From 1963 to 1971, over 400 hybrids were screened at Kentville for silage and grain production. Many of the hybrids, if they showed promise in screening trials, were evaluated at different locations in the Atlantic region. Since 1972, many more hybrids have been evaluated; presently 200 hybrids are being evaluated at Kentville and over 60 at other research establishments in the region.

Plant population studies carried out at Kentville in 1966 and 1967 using the hybrid Haapala H175 favored a row width of 15 in. and a plant spacing of 13 in. for both silage and grain production. These spacings provided slightly more than 31,000 plants an ac. However, when this hybrid was planted on the square 20 in. x 20 in. and plant population was reduced to slighly over 15,000 plants an ac, yields were not greatly reduced in 1966 but were considerably reduced in 1965. A similar trial carried out in 1967 using Pride 5 as well as Haapala H175 showed no significant difference between hybrids or plant spacings. A trial conducted in 1971 using populations of 23,000 and 46,000 plants an ac showed about a 2 ton/ac increase in total dry weight at 46,000 plants an ac. Grain yields varied although they generally favored the higher plant populations when five hybrids were used. Plant populations of

Corn silage is fed to dairy cattle on a modern dairy farm.

Bunker silos are frequently used to store corn silage in the Maritimes.

20,000 to 24,000 plants an ac are being recommended for the region.

Dates of seeding trials at Kentville indicate that mid-May is the best planting time. However, the soil temperature should reach nearly 50°F. before corn is planted. This usually happens in the Kentville area by mid-May. At Nappan we have found the last week of May or very early June is the best time to plant corn.

Dates-of-planting studies have been conducted at most research establishments and dates vary with location. Early planting can be an advantage if planting is not followed by wet, cold weather which may kill corn seedlings.

Weed control is generally not a problem in corn, especially if it is continuous corn and good management is used. Weed control studies continue to be carried out at Charlottetown and the herbicide residue problem is being examined. Most corn is treated for seed corn maggots and wireworms. For untreated corn, diazinon-lindane combinations are usually readily available.

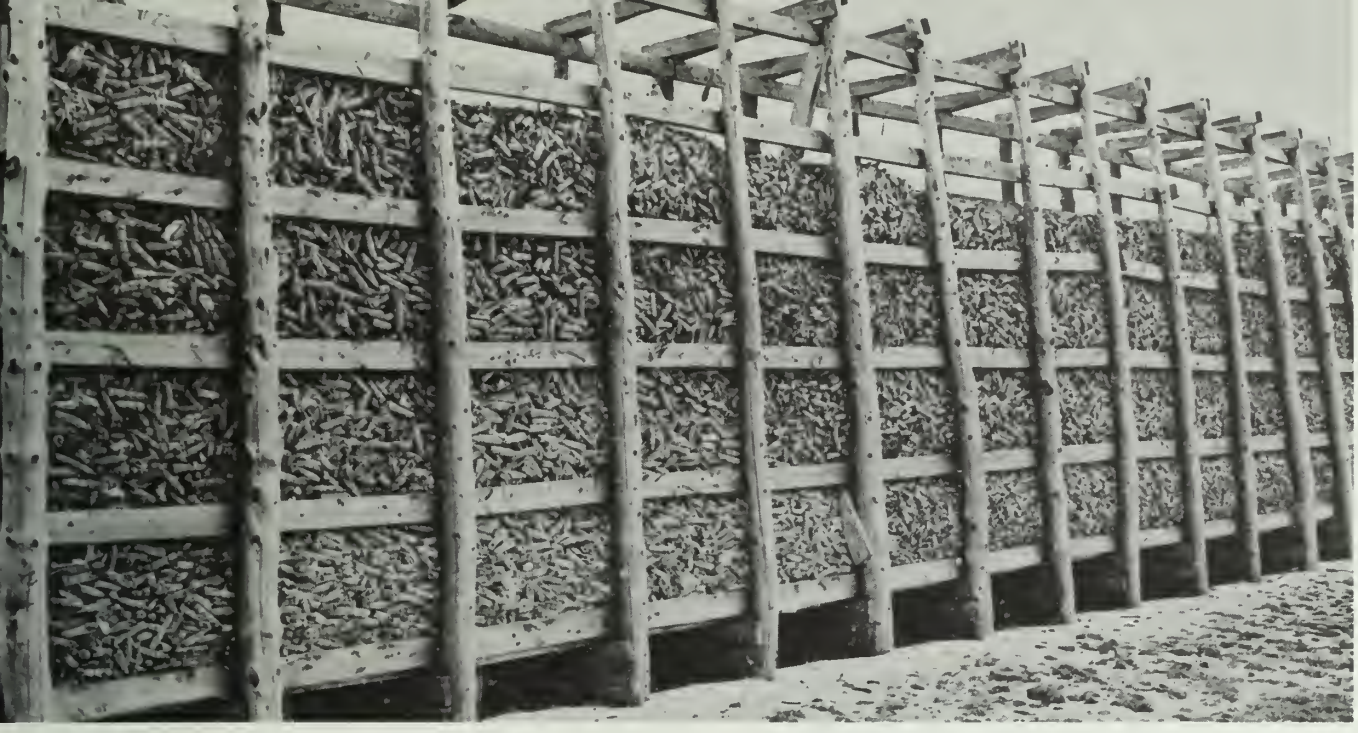
At present, there is an estimated 15,000 acres of corn grown in Nova Scotia with approximately 2,300 acres in grain corn. In New Brunswick, an estimated 8,500 to 9,000 acres of silage corn is grown. On Prince Edward Island, corn acreage is expanding rapidly with an estimated 7,000 acres in 1973 and 10,000 acres in 1974. Cribbed corn is being fed to livestock, with Nova Scotia leading the way.

Coordinated regional trials are carried out at the Agriculture Canada research establishments in Fredericton, Kentville, Nappan and Charlottetown. In addition, trials are conducted at one location in New Brunswick by the province and at the Nova Scotia Agricultural College in Truro.

A corn ''heat unit'' study has been underway for the past 3 years at all Agriculture Canada research establishments in the Maritime region and at the Nova Scotia Agricultural College. This work is coordinated by Mr. Andrew Bootsma, agriculture climatologist with the Prince Edward Island Department of Agriculture and Forestry. We planted a replicated trial containing Haapala H175 (early maturing), Pride 116 (medium maturing) and Pride 5 (late maturing). We recorded air temperatures twice daily at the weather stations on the establishments and soil temperatures were recorded where possible. Samples of grain were taken in the fall to determine when kernel moisture reaches 50 percent. The corn ''heat units'' are then determined for each location for each hybrid as it reaches this stage of maturity.

Currently, fertility studies are being carried out at the Charlottetown Research Station. Rates of application of nitrogen, phosphorus and potassium are being studied in relation to soil test values. Researchers have found that applications of phosphorus increased yield and improved maturity. There was no response to applications of potassium but maintenance amounts are required. Sources of nitrogen are also being examined in the region along with the time of application.

Trials with no tillage, minimum tillage and normal tillage have been carried out and are continuing to be evaluated. Present data have shown that no tillage is valuable on some soil types and minimum tillage will lower the cost of production. Spring and fall plowing are being examined at Charlottetown.



A corn crib in Nova Scotia for storing grain corn.

Spring plowing followed by a clod-buster tiller worked well.

Dates of harvest were studied at Nappan over a period of 4 years with the silage fed to steers in the winter. We found that silage made in mid-September was better than either silage made from corn which was frozen and harvested in late October or silage from material harvested in late August. It was also found that trafficability of the land was usually best from mid-to-late September. Dates of harvest are now being examined at Charlottetown to determine the best time to harvest in that area.

The latest effort on breeding assessment, which began in 1974, is to increase the size of the regional trial to 25 entries at all locations and increase the efficiency of the breeding assessment program. This will eliminate all other breeding assessment work with the exception of a screening trial at Kentville.

Dr. Lorne Donovan, corn breeder at the Ottawa Research Station, visited many corn growing areas in the Maritimes during the summer of 1973. While visiting Agriculture Canada research trials and on-farm trials carried out by the provincial departments of agriculture, he suggested the possibility of developing a 2,200 to 2,300 ''heat unit'' grain corn. It would be adaptable to areas that are presently borderline for grain corn and extend the boundaries to areas which only grow silage corn at present. This type of material is being evaluated in 1974 at Fredericton, Charlottetown, Kentville and Nappan. Twenty entries are included in these trials. As birds are becoming a very serious problem all material must be bagged to obtain true grain yields.

A hybrid of this type is being sought to compete directly with cereal grains and yields in excess of 50 bu/ac are desired. This would provide the farmer with another crop for crop rotations. With the proper use of herbicides, corn could help to solve the weed problem, especially couchgrass, in a rotation with cereals. Crop rotation can also aid in control of diseases of cereal and protein crops as well as the insect problem with corn.

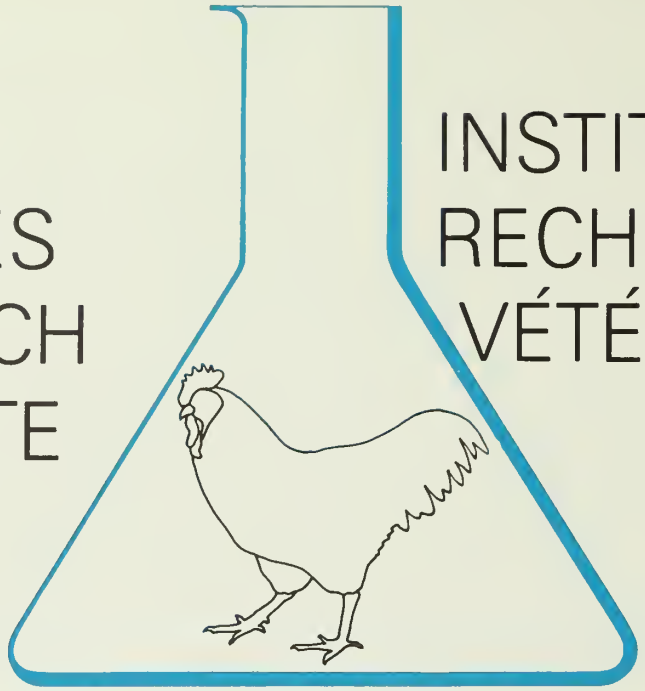
In addition to the research trials with low ''heat unit'' corn, 21 breeders' lines will be examined at ''on-farm'' locations. This will be carried out by soil and crop specialists at one location each in New Brunswick and Prince Edward Island and two locations in Nova Scotia. An assessment will be made to compare them with Haapala H175 which is the earliest maturing hybrid presently recommended for the area.

One research scientist from each of the Research Stations at Charlottetown and Kentville will examine the European corn borer problem. They will attempt to assess actual damage and appropriate control measures.

Agriculture Canada researchers and provincial crop extension workers meet twice a year to discuss problems related to corn and keep information in the corn section of Publication 100, ''Field Crop Guide for the Atlantic Provinces'', up-to-date. This is a regional publication and material contributed to it is supplied by many people in the region.

Soil erosion, soil drainage, European corn borer and bird damage to emerging fields and those approaching maturity are still serious problems. Earlier maturity and high dry matter content are of prime importance to many areas in the region. ■

ANIMAL DISEASES RESEARCH INSTITUTE (EASTERN)



INSTITUT DE RECHERCHES VÉTÉRINAIRES (EST)

The goal of Agriculture Canada's Health of Animals Branch is to maintain a livestock population as free from disease as possible. But disease cannot be eliminated without knowledge. For this reason, the Animal Diseases Research Institute (ADRI) of the Animal Pathology Division is responsible for research, diagnosis and production of diagnostic reagents.

ADRI's new eastern laboratory in Ottawa is the latest in animal research facilities. Here, in one of the most modern veterinary research laboratories, scientists are seeking ways to conquer infectious diseases that rob Canadian livestock producers of millions of dollars each year. When diseases are adequately controlled, healthy cattle, hogs, poultry and sheep will supply Canada with more food at lower cost.

Le but de la Direction de l'hygiène vétérinaire d'Agriculture Canada est de conserver notre cheptel aussi sain que possible. Toutefois, les maladies ne peuvent être combattues qu'en les connaissant. C'est pourquoi l'Institut, partie de la Division de pathologie vétérinaire, est chargée de la recherche, du diagnostic et de la production de réactifs servant au diagnostic.

Situé à Ottawa, ce nouveau laboratoire serait parmi les plus modernes. Dans ces locaux, les scientifiques cherchent à cerner les maladies infectieuses qui, chaque année, dérobent aux éleveurs des millions de dollars. Grace à la répression des maladies, des bovins, ovins, volailles et porcs plus sains, fourniront des aliments et autres produits plus rentables.

(Top left) An aerial view of the new Animal Diseases Research (East) complex showing the main building and the poultry and livestock barns.

(Center left) Scientist examines poultry for Newcastle disease.

(Bottom left) The sewage treatment system sterilizes the sewage under steam pressure before it enters the main sewage system.

(Top right) A modern 190-seat auditorium provides complete facilities for seminars, lectures and large meetings.

(Center right) Specimens are examined in the modern pathology laboratory.

(Bottom right) An aborted calf fetus is examined in the necropsy room for brucellosis.

(En haut, à gauche) Vue aérienne du nouvel immeuble de l'Institut de recherches vétérinaires (Est) qui représente l'édifice central, le poulailler et les étables à bestiaux.

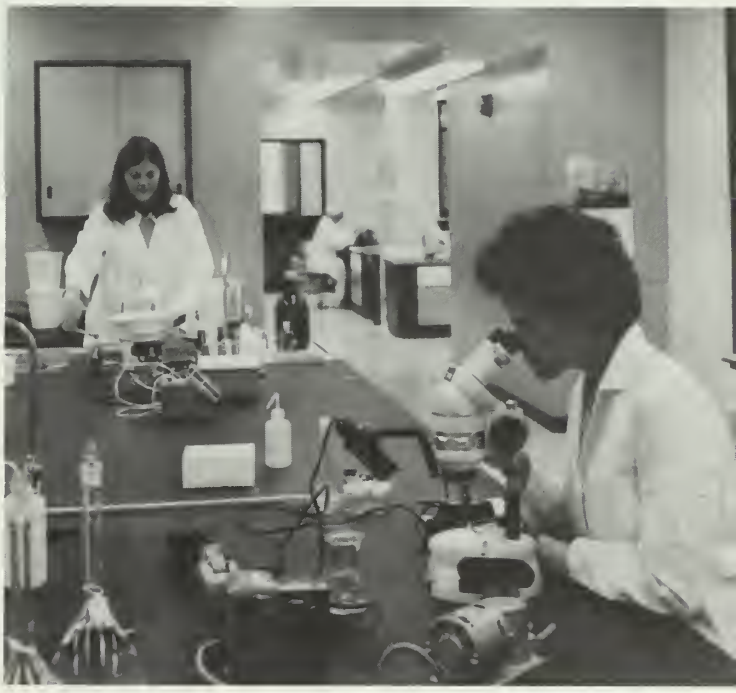
(Au centre, à gauche) Examen d'une volaille en vue du dépistage de la maladie de Newcastle.

(En bas, à gauche) Le système de traitement des égouts stérilise les eaux résiduaires à la vapeur sous pression avant de les laisser passer dans le système principal d'égout.

(En haut, à droite) Un auditorium moderne de 190 sièges offre les facilités nécessaires à la tenue de colloques, de conférences et de grandes réunions.

(Au centre, à droite) Examen de spécimens dans le laboratoire moderne de pathologie.

(En bas, à droite) Dans la salle d'autopsie, on examine un fœtus de veau avorté pour la brucellose.



FEEDING THE WORLD POPULATION

Comments of international authorities on food resources and distribution were gleaned from the OAC Centennial Symposium, Agriculture in the Whirlpool of Change, held at the University of Guelph, October 1974.

Les commentaires des sumnités internationales sur les ressources en nourriture et leur distribution ont été recueillies au Symposium du Collège agricole de l'Ontario, ''Agriculture in the Whirlpool of Change'', tenu à l'université de Guelph en octobre 1974.

Global Land Resources and Their Potential

Estimates range from 6 to 9 billion ac of arable land. Variation stems largely from conclusions as to which arid and tropic land may be arable.

Of the total supply, nearly 3.5 billion ac is intensively farmed with the remainder mostly grazing land. A small amount—perhaps up to 10 percent—of grazing land can be converted to intensive cultivation without adjustments in technology. The remainder will require major technological changes.

FAO has established what is called a standard nutritional unit which is 2350 calories per day or 857,750 calories per year per person. To satisfy this requirement it takes an average of 1.4 ac of plant production or 4.3 ac devoted to animal production. Thus, satisfying the demand for animal products typically requires over three times as much land. *Daniel G. Aldrich, Jr., Chancellor, Irvine Campus, University of California.*

Meeting the Demand

The projected growth rates of demand for food in the developed countries—1.4 to 1.7 percent annually—are low, reflecting slow population increase and low income elasticity of demand for food.

Demand for food is projected to grow much faster in the developing countries—3.1 to 4.0 percent per year—because of rapid growth of population and the low starting levels of food consumption.

The extrapolated growth rates of food production—2.4 to 3.5 percent per annum—are more comparable for all groups of countries. But for developed countries they exceed considerably the projected growth rates of demand, while for developing countries they fall considerably short of demand growth.

If the comparison between demand and production is made at the world level, it would appear that food production could exceed the growth of demand, the surplus capacity of the developed countries more than offsetting the deficit in the developing regions. This is a purely arithmetical result, and is not the solution to the world food problem.

It is comforting that world agriculture appears to have the potential capacity to produce sufficient food to meet the projected demands of humanity, at least up to 1985. But the developed countries will not continuously produce export surpluses up to their capacity if there is no one to buy. For cereals only, the above projections imply a cereals

deficit in the developing importing countries by 1985 of around 100 million tons a year, three times their gross imports in 1969-71. This quantity could cost 15-20 billion dollars, about equal to the total current flow of official and private funds to developing countries. It is impossible to foresee the developing countries themselves being able to pay for such imports, and there is no indication at present that either the exporting countries or the world community as a whole would foot the bill. There is a more fundamental point. Charity, however worthy and indeed indispensable in times of famine threats, is not a solution compatible with world development and with agriculture's contribution to it. North American and European agriculture could produce food for the developing countries, but not incomes for their farmers.

If world agriculture is to rise to the challenge of its potential importance to humanity, top priority must be given to speeding up the growth of food output and agricultural productivity in the developing countries. The task is clearly defined. It is to raise the rate of increase in food production in the developing regions of the world from the present trend of 2.6 percent a year to 3.6 percent a year. Every year of shortfall below the target is a year of hunger for millions.

The prime responsibility for modernizing rural development in the developing countries rests with the governments of those countries. But assistance is needed from all other countries, in a position to help, on a scale that breaks dramatically with the modest levels of today.

Humanity can no longer do without a world food policy, to be defined, adopted and implemented by all nations, as a common task. The elements of such a policy should include:

- Acceleration of the rate of increase of food production in developing countries by 40 per cent overall.
- Mobilization of the additional international resources needed to supplement the efforts of developing countries to achieve this acceleration in food production.
- Implementation of a global policy of minimum food security, based primarily on a coordinated network of national stocks.
- Establishment of an improved world food information and outlook system.
- The design and implementation of more effective food aid policies for emergencies, supplementary feeding programs and developmental and stock-building projects in developing countries.
- The declaration by governments and industry of some type of world fertilizer policy, designed to ensure that farmers, particularly in developing countries, have access to adequate fertilizers and other modern inputs, on which the success of the "green revolution" depends. *E.M. Ojala, Assistant Director General, FAO, Rome.*

PROJECTIONS OF FOOD DEMAND AND EXTRAPOLATIONS OF FOOD PRODUCTION TO 1985

Volume Growth Rates

	Demand	Production[1]
	percent	per annum
Developed countries	1.5	2.8
Market economies	1.4	2.4
Eastern Europe and U.S.S.R	1.7	3.5
Developing market economies	3.6	2.6
Africa	3.8	2.5
Asia and Far East	3.4	2.4
Latin America	3.6	2.9
Near East	4.0	3.1
Asian centrally planned economies	3.1	2.6
All developing countries	3.4	2.6
World	2.4	2.7

[1]Base penod 1961-73
Source FAO

Social, Economic and Political Constraints

What is obviously required to eliminate these types of constraints to increased agricultural production is a world agricultural policy. However, in point of fact, there isn't one. What exists instead and what is likely to continue to exist as a world agricultural policy is simply the sum of differences of residual remnants of domestic policies. Very few countries, if indeed any, are willing to forego their national rights to make their own domestic decisions in the area of agricultural policy. In many instances, these domestic policy decisions have serious consequences for the productivity of world agriculture. What happens in very general terms is that the socio-political difficulties associated with a commodity problem in one country receive a domestic remedy, often incorporating increased protection and/or export subsidies which frequently have direct domestic economic consequences for a country that exports directly to the first and that effect is transmitted to other competing exporters. These in their turn attempt to seek their own domestic solution to the problem. If they can find such a solution and afford it when found, then their domestic actions will have further global consequences which are no more likely to increase world agricultural productivity than the initial domestic policy decisions to which they are reacting. *G. I. Trant, Director-General, CDA Economics Branch, Ottawa.*

Land Resources—The Next Hundred Years

One of the challenges to be met is to devise near-automous municipal institutions that can become the decision-maker and implementers for public policy as close to the point of development as possible.

The whole existing rigid planning system can be expected to break down, because it is stifling development and increasing the burden on the community, without doing much more than rigidly controlling everything. This is because our planning system ignores the realities of land ownership and land economics, and in particular has adopted a stance which does not forecast nor lay out strategic alternatives, but which adopts dogmatic socialist ideology and sets its face against private land ownership and against private development. In particular, it is built on the foundation of the police power, instead of on a realistic system of compensation and betterment, and on punitive treatment of the entrepreneur in all fields. *Norman Pearson, Professor, Political Science, University of Western Ontario.*

Changes in the Human Social Environment

Rural communities cease to be a mixture of income groups and social classes all with a common interest and concern in the fortunes of local agriculture. They become much more heavily dormitory places with the upper middle class dominating in terms of the services provided, the shopping pattern and the attitudes expressed as to the desirability of future changes. Rural settlements become more and more things of preservation, removed from the dynamics of local agriculture and often with attitudes of mind and craft activities which pull strongly towards a type of rural economy which is long past. Out of this develops strong preservationist groups and attitudes which form the backbone of so-called conservation movements.

I expect that this type of movement in all its manifestations will continue to be dominant for many years to come. *Gerald P. Wibberly, Professor of Countryside Planning, University of London.*

Food-population Dilemma

Is either Europe or Japan aware of their immense reliance on distant lands and oceans? Do the Europeans realize that their net importation of plant protein through food and feed commodities exceeds the total intake of India or that it is one-fifth above that of Africa? Or, have either the United Kingdom or Japan grasped the fact that their respective imports of plant protein by far exceeds the average annual purchases of either India or China in the world market?

There are innumerable indicators of the extravagance of this luxury enclave or protein sanctuary, composed of North America, Europe, the USSR and Japan. Several European countries put more fish protein into animal production than into human food (in Holland eight times more) and import more plant protein as feed than what their population consumes directly. A number of affluent countries are using more dried skim milk in animal feeding than what their humans are getting. Others discard as dairy waste more protein than is eaten as meat in the same countries.

At the root of the ecology crisis as related to food is the long distance hauling over land and oceans. The urban millions lost touch with their survival basis, and the imports

were visualized only in trade figures as tonnage or money value. The awareness of what it takes in land, water and storage to feed each person or family, that once characterized the subsistence farm, has by and large dissipated under the euphoria of technical and economic "miracles". *George Borgstrom Michigan State University, East Lansing.*

Binational Goal

Urgently needed is a national goal, let us say a binational, a U.S.A.—Canadian goal for enhancement of agricultural productivity. I have suggested a 50 percent increase in the next five years. Such a goal would be less than 10 percent a year, since the gain would be compounded annually. It should have a significant impact on world trade, balance of payments, re-establishing the integrity of the dollar, putting a brake on spiraling inflation, and in meeting the food needs of hungry nations—possibly averting starvation of millions. It would rebuild dangerously low food stocks and re-establish price stability. *S.H. Wittwer, Director, Experiment Station, Michigan State University, East Lansing.*

Nutritional Demand

The problem of under-nourishment is reflected mainly in the number of calories consumed per day by comparison to the nutritional requirements: 2,300 calories for Asia, 2,400 for the Near East, Africa and Latin America. But even more important is the malnutrition due to a lack of balance in the diet. To have a balanced diet it is generally accepted that proteins should represent 12-15 percent of total colories (with animal and vegetable proteins in about the same proportions) and fats should represent 28-35 percent of total calories. It could be assumed that a daily intake of 450-500 animal calories would cover these nutritional requirements.

Moreover, it is well known that the quality of a protein is equally of paramount importance: if an important amino-acid is in insufficient quantity in a protein, the biological value of that protein can be seriously reduced. The following table provides some information in this connection. *A. Simantov, Director of Agriculture, OECD, Paris.*

Food in Have-not Areas

Of 100 developing countries, 73 became independent after 1945. The people chose independence and freedom first—they have not demanded the right to be fed. Until the people of a nation demand of their government an explanation for their inadequate food producing capacity and until they demand the right to be fed, little agricultural progress may occur. First indications of this action may be witnessed in the September 1974 downfall of the Ethopian government. An explanation of why hundreds of thousands of people were allowed to die in the 1973 drought was demanded. *Neal Stoskopf, University of Guelph.*

Future for Meat

It appears there will be an ample supply of meat for the consumer if he or she is willing to pay the price for it. If the Federal Government brings out its announced regulations for extended and substitute meats, it seems likely that these products will make up a bigger portion of the consumer's meat supply. Further improvements in processing, packaging and convenience features will appear. In conclusion, Canadians will in the future, as in the past, be able to enjoy a safe and high quality supply of meat. *D.W. Stanley, Department of Food Science, University of Guelph.*

Communicating Technology

Extension services have generally been found to be ineffective. This arises from the divorce of research from extension. The extension man literally does not know what research has accomplished, hence he has nothing to extend. I feel strongly that methods must be devised to provide "in country" training of extension personnel. Such training should be done at an active centre of research by competent production agronomists with one foot in research and the other in the farm field. Emphasis in training should be placed on the farm demonstration. Training should not emphasize methods of extension such as the flip chart and the bulletin combined with a new language which no other scientist can understand let alone the farmer. It is only by practical training "in country" that sufficient numbers of effective extension people can be generated. In the absence of this type of training, it is necessary for the research scientist to move off the station and put in farm demonstrations in collaboration with local extension personnel. In this way, the advantages of the research package is demonstrated to both extension agents and the farmer. It has the further salubrious effect of acquainting the researcher with the problems the farmer has to face in growing his crop. *R.G. Anderson, Associate Director, International Maize and Wheat Improvement Centre, Mexico.*

Nutrients for Animal Production

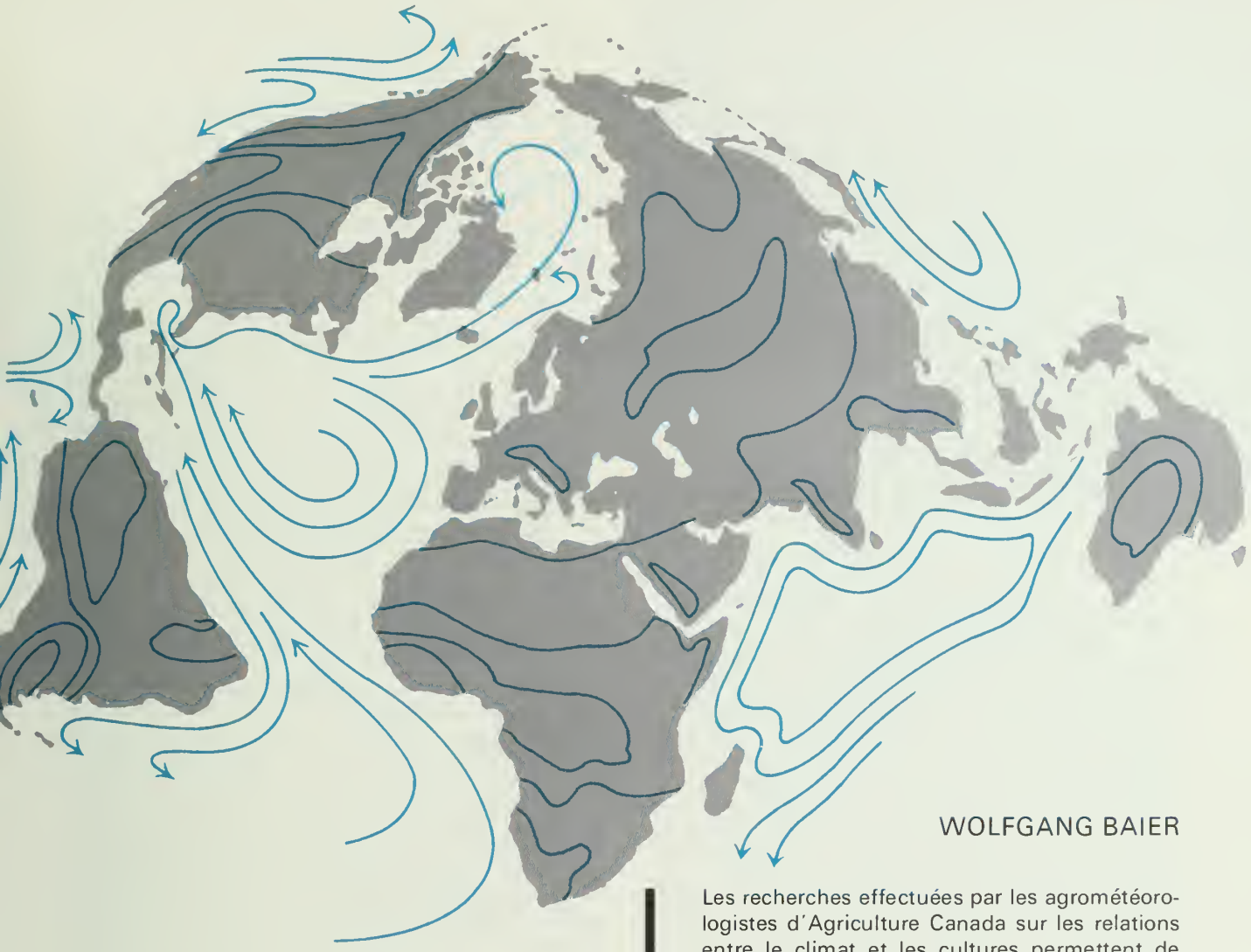
The amount of feed which is required to produce unit weight of consumable meat in any species of animal does not consist solely of the amount of feed consumed by the individual animal devided by the amount of meat in its body when it is slaughtered. To the total feed input to the final meat animal must be added that amount which had been consumed by the breeding herd or flock from whence it came and that consumed by the stock which had to be reared and kept to replace that breeding stock. In addition, we have to add the feed consumed by any of its confreres which, as a result of accident or disease, died or were disposed of before they reached marketable weight. The table summarizes calculations which indicate the magnitude of these not so much hidden as ignored costs in terms of feed of producing muscle tissue. The figures apply to United Kingdom conditions, but the principle is general. The same basic feed of barley grain is the common denominator. While the data show a vast superiority of pigs as grain converters, they cannot show that cattle kept on intensively managed pastures achieve rates of beef production per acre of pasture which are similar to rates of pig meat production attained per acre of land producing grain. The salient point is that direct feed costs of producing carcass meat are only about a quarter or a third of the total, even under the husbandry conditions of the United Kingdom. Two to three times as much feed is used to produce the calf to be fattened as is used in fattening it. Obviously, in any world context, we must consider these whole population utilizations of feed resource rather than single out particular facets. *K.L. Blaxter, Director, Rowett Research Institute, Aberdeen, Scotland.*

COMPARATIVE VALUE OF FOOD PROTEINS

Source of protein	Limiting factor	Percentage of deficit of limiting factor (P)	100-P	Biological value
Egg (whole)	none	0	100	96
Beef meat	cystine & methionine	29	71	76
Cow's milk	cystine & methionine	32	68	90
Soya (cooked)	methionine	51	49	75
Rice	lysine	61	39	78
Wheat	lysine	63	37	67
Maize	lysine	72	28	54
Peanuts	methionine	76	24	54
Peas	methionine	76	24	48

FEED COSTS OF PRODUCING MUSCLE TISSUE IN FATTENED LIVESTOCK IN TERMS OF GRAIN (KG FEED / KG MUSCLE)

Species	Directly used in the fattened animal	Indirectly used: Maintenance of breeding stock	Indirectly used: Replacement of breeding stock	Total feed (with meat from culled stock added)
Sheep	15.0	31.2	13.0	44.9
Pig	9.4	2.5	0.4	12.1
Cow	14.5	23.8	7.1	34.6



WEATHER AND WORLD FOOD SITUATION

WOLFGANG BAIER

Les recherches effectuées par les agrométéorologistes d'Agriculture Canada sur les relations entre le climat et les cultures permettent de faire des prévisions sur les conditions des cultures et leurs rendements en se basant sur les données météorologiques du Canada. L'objectif des agrométéorologistes est d'analyser les données météorologiques passées et d'indiquer les conséquences de la température ou les variations probables du climat sur la production des cultures.

The present critical world food situation has aroused considerable public concern, and led to numerous reports and statistics on the effects of weather and climate on crop production. The evaluation of such information is somewhat difficult since there are many assumptions involved in the interpretations presented by experts from various disciplines.

Our research into crop-weather relationships has made it possible to demonstrate the feasibility of providing estimates of crop conditions and yields from current weather data in Canada. It is expected that this approach will be followed by other countries and agencies in order to monitor regional and eventually global food production.

Dr. Baier is Head, Agrometeorology Research and Service, CDA Chemistry and Biology Research Institute, Ottawa, Ontario.

Weather Variability Versus Climatic Change

The new world food situation emphasizes the need to give more serious consideration to an analysis of our climate as a natural resource. A classical definition of climate has been as ''average weather'', but it is now realized that the concept of ''climate'' should be defined in terms of the variability of weather over long periods of time and over large regions.

Recent analyses of data for Canada and the United States have indicated that the growing season weather in the Great Plains has been less variable during the past 1 or 2 decades than during preceding decades. It has also been demonstrated, especially for U.S. corn yields (and to a lesser extent for wheat and soybeans), that the average or normal weather in the corn belt is nearly optimum for corn yields. Generally, the weather has been better for grain production during recent decades than previously. Similarly, favorable and less variable conditions during the most recent 2 decades have been indicated in some studies in Canada and have probably also occurred in other major crop producing areas of the Northern Hemisphere.

There is also an overall trend in climate towards cooler conditions in parts of the Northern Hemisphere. Surface temperatures averaged over the Northern Hemisphere have been falling from the 1940's to at least the early 1970's; the five-year average, 1965-69, was about .3°C lower than the 5-year average, 1938-42. In the Arctic, the cooling has been considerably greater. The average temperature for the period 1960-69 was about 4°C lower than for any 10-year period since records became available in 1920. In January 1973, the Labrador Ice Sheet extended beyond its previous record in the area east of Newfoundland. From the evidence available it appears that in the Southern Hemisphere the changes are less significant.

Such changes have a substantial impact on the length of the growing season, particularly in crop growing regions at higher latitudes, and on the weather pattern during the growing season. Until the mechanism causing such a change as well as the year-to-year fluctuations in weather patterns are clearly understood and the possibilities of predicting these changes in climate and weather have greatly increased, agricultural planners and decision-makers of food supply systems must rely on two premises:

- Weather and events that affect agricultural operations and production can be estimated on a probability basis from a statistical analysis of the variability of past weather over a period of 50 years or more. Probability statistics based on daily weather records are available in Canada for climatic data (e.g. occurrence of freezing temperatures), derived agroclimatic data (e.g. irrigation requirements) and agricultural production (e.g. yields).
- Such events might occur in any spatial combination at the same time or they can occur over a sequence of years over a given region. This information is scarce on a regional or global scale and research into such distributions is urgently needed.

Impact of Weather/Climate Variations on Agricultural Production

The possibility cannot be ruled out that the reported slow overall cooling over much of the Northern Hemisphere (particularly in the latitude zone 60°-30°North) may continue or even intensify. Although above average yields could be expected in a few favored areas, the overall production would be markedly below average. It can also be expected that year-to-year weather variations in the future will be greater than in the most recent decades. Marginal agricultural areas in Canada and in other parts of the world, such as the fringe areas of the deserts and the flood plains in monsoon areas, will be particularly hard-hit because there are usually one or more climatological factors near the critical levels to which crops respond. A small change in any one of these factors may mean the difference between acceptable crop production or crop failure.

In view of the new situation in regard to weather/climate and food production, the role of the agricultural meteorologist is even more important. His objective is to analyze past weather records and to express quantitatively the effect of the weather as recorded or of assumed climatic changes on the production of selected agricultural crops. This provides basic information on how to judge the probabilities of success, partial success or failure of agriculture decisions, and whether or not the frequency of these failures will make the venture too risky. Such information can be used to assess the yield potential of soil management units, to determine optimum land use and will serve as a useful guide to the type and variety of cereal crops which may be successfully introduced in a new area. The results of these analyses should be particularly useful to plant breeders or geneticists for the development of varieties adapted to

greater year-to-year weather fluctuations and to a cooler and shorter growing season.

Action Proposed

From the viewpoint of an agrometeorologist, the following action is proposed to respond to the new climate/food situation through increased application of meteorological knowledge in agricultural management, technological practices and food security planning.

Research It is recommended that emphasis be given to:

- Crop-weather data acquisition experiments on a regional and global basis with special emphasis on wheat, rice and corn.

The Commission for Agricultural Meteorology of the World Meteorological Organization has recently established two working groups on International Experiments for the Acquisition of wheat and lucerne data through international experiments to provide comparable agrometeorological and crop data as required for the development of crop-weather models.

- Strengthening agricultural research in view of the possible effects of greater year-to-year variations in weather and a long-term cooling trend on crop and animal production, on the efficient use of soil-climate resources, and on the efficiency of agricultural systems in general.

Agricultural meteorologists have developed crop-weather models for the analysis, assessment and prediction of crop responses and crop yields from meteorological data and agricultural statistics. Such models have been used successfully to assess the influence of weather on the production of certain crops. They have also been used to study the effects of simulated changes in climate on the production of selected crops.

- The development of crop-weather models and crop calendars for national and eventually regional and global estimates of the quantity and quality of crop yields.

The feasibility of monitoring crop conditions in terms of expected yields from current and immediate past weather data has been demonstrated, especially in Canada. Some other countries are also using such weather-based estimates for selected crops.

- Establishment of a crop-weather information bank available to all researchers.

Such an information source would include long-term averages of climatological data for years, months, 10-day and 5-day periods and in some cases even daily records for a number of key-stations; crop and soil data; references to crop-weather studies; available probability analyses; computer programs; and other relevant information on national and international agreements.

Services Immediate attention should be given to strengthening National Meteorological Services in order to provide improved services to agriculture in all fields of weather-sensitive problems.

Assessments All available meteorological information should be exploited for the regular assessment of the world's current and past weather. Such assessments would allow the detection of significant changes in weather patterns such as the onset of drought conditions.

Likewise, all available agrometeorological knowledge and meteorological data should be used for the development of regional or global systems for monitoring the progress of growing crops and estimating potential yields. This information would enable better management decisions to be made with respect to agricultural production, storage, marketing and food distribution.

Meteorological Services Immediate attention should be given to strengthening National Meteorological Services in order to improve services to agriculture in all fields of weather-sensitive problems.

The success of such efforts is dependent on improved communication and close collaboration between agricultural researchers, meteorologists and the ultimate users of agricultural weather services.

Crop Condition Assessments All available meteorological information should be exploited for the regular assessment of the current and past weather. Such assessments would allow the detection of significant changes in weather patterns such as the onset of drought conditions.

Likewise, all available agrometeorological knowledge and meteorological data should be used for the development of regional or global systems for monitoring the progress of growing crops and estimating potential yields. This information would enable better management decisions to be made with respect to agricultural production, storage, marketing and food distribution.

Outlook

The World Meteorological Organization through the World Weather Watch (WWW) has developed a program for the routine exchange of global weather reports. These reports provide every six hours most of the elements required in practical crop-weather models. What does *not* exist is the monitoring of the world's weather in a form that is suitable for use as an input into a program for assessing crop conditions and expected yields.

The Commission for Agricultural Meteorology of the World Meteorological Organization recently developed during its 6th Session at Washington, D.C. a World Agrometeorological Program in Aid of Food Production. In addition to the above components of research, services and assessments on an international scale, this program also proposes special training in agrometeorology for developing countries to assist them in their efforts to increase food production. It is hoped that the forthcoming 7th WMO Congress will provide the necessary funds for the implementation of this global program. ■

ECHOES
FROM THE FIELD AND LAB

This 5-year old bull. developed by the Lethbridge Research Station in the 1960's, is one-eighth bison.

CATTALO—BOON OR BUST? Cross-breeding cattle with North American bison may be a boon to the beef industry in some areas, but most farmers should stick to crosses between cattle herds, advices J.E. Lawson, an animal geneticist at the CDA Research Station, Lethbridge, Alberta. There has been a lot of interest recently in crossing cattle with the native bison, but the idea isn't new. Mr. Lawson notes that crossbreeding was observed in the 1700s and ranchers made attempts to get the two species to mate in the 1880s.

Research by Agriculture Canada scientists on a herd of bison-cattle developed at Wainwright, Alberta, in 1916 and sold in 1965 after they had been evaluated on range conditions indicated that they had some definite weaknesses. Some of the problems encountered with the Agriculture Canada project included calving problems, weak calves, low rate of gain under feedlot conditions, mating problems and low fertility in the bulls. Part-bison animals, however, were more hardy and cold-resistant than ordinary cattle. On northern ranches where cattle cannot be raised profitably, bison-cross beef animals could be very adaptable.

SILAGE RESEARCH Silage, in its many forms, will supersede the old hay crop as research continues, notes Dr. Raymond Lessard, a nutritionist and forage conservation specialist at Agriculture Canada's Animal Research Institute. The aim of the research project led by Dr. Lessard is to provide low-cost feed with high protein content and little regard for weather conditions. Tower silos are commonly used for storing forage, but they have their shortcomings. Forage must be wilted when it is stored—containing not more than 70 percent moisture.

The Agriculture Canada project involves studying horizontal silos. Although they aren't particularly new, Dr. Lessard notes that no one has really studied them to determine their value. The main advantage of the bunker silos, in addition to lower construction costs, is that the moisture content of the forage can be as high as 80 to 85 percent. According to Dr. Lessard, this means that the forage can be harvested and blown into the silo. The farmer doesn't have to wait for the wilting process to reduce the moisture content, the protein content will be higher, and less manpower is required at harvest.

In future tests, pure alfalfa will be stored in bunker silos with formic acid added as a preservative. This assures the lowering of the pH level in the alfalfa silage, making it more acid. Dr. Lessard hopes that the protein content will be as high as 20 percent for alfalfa used in future tests.

FOREIGN X DOMESTIC HYBRID HEIFERS A new publication entitled "First-Calf Performance of Foreign X Domestic Hybrid Heifers", evaluates the reproductive performance of hybrid heifers produced by mating Charolais, Limousin, and Simmental bulls with Angus, Hereford, and Shorthorn cows. This publication is based on research conducted by H.D. Fredeen, J.E. Lawson, J.A. Newman, and G.W. Rahnefeld at the CDA Research Stations at Lacombe, Alta., Lethbridge, Alta., and Brandon, Man.

The mating plan to produce the original hybrid heifers resulted in nine hybrid combinations—three sire breeds X three dam breeds. A tenth group, the Hereford X Angus cross, was added to serve as a control population. The publication summarizes breeding, conception, and calf performance to weaning for 1972 and 1973 first-calf production from 1000 hybrid heifers. Results at this point must be regarded as tentative pending completion of the 1974 calving year.

To obtain this publication, request Publication 1537, 1974, from: Information Division, Agriculture Canada, Ottawa, K1A 0C7.

AI FOR SWINE Swine AI is becoming more acceptable as hog producers become more conscious of disease control and carcass quality, observes Hans Grieger, head of Agriculture Canada's sheep and swine production. Semen used for artificial insemination is taken only from Record of Performance-tested boars.

An artificial insemination unit for swine was recently opened in Woodstock, Ont. It is owned by the Ontario Swine AI Association, a swine-breeder organization, and is backed financially by the federal and provincial governments and the Ontario Pork Producers' Marketing Baord. A second unit is in operation at La Pocatière, Que. Agriculture Canada's Sire Loan Program provides top-performance boars for swine AI units. The new Woodstock unit has acquired 20 boars under the program and is aiming for 30.

The demand for AI swine is growing. In 1973 in Canada, 1,154 swine were artificially inseminated. According to Mr. Greiger, that number more than doubled in 1974.

To ensure optimum fertility, swine semen must be used within 72 hours. When the technique for freezing semen has been improved, breeders living further than the distance semen can be shipped within 72 hours will be able to take advantage of AI. Meanwhile, researchers are continuing to look for an improved method of freezing boar semen.

DILL PROMISING FOR PRAIRIES Test plantings of dill on commercial acreage in Manitoba indicate that the crop could provide the basis for a new agricultural industry on the Prairies. Groundwork for possible new dill oil production in western Canada was the result of several year's experiments at the CDA Research Station, Morden, Manitoba. Research conducted by Gordon Dorrell and Bert Chubey, oilseed quality and food technology specialists at the station, showed that yield and quality of dill oil from crops grown in the Morden area were good enough to consider commercial production.

Gross return per acre was about $400. The combination of good profit and a high quality product indicate another potential crop. The project is now a joint venture of the Morden Research Station, the Manitoba Research Council and the Manitoba Department of Agriculture.

ECHOS
DES LABOS ET D'AILLEURS

LAMB PROCESSING PLANT A sheep and lamb processing plant presently under construction at Innisfail, Alberta, is expected to commence operations in March, 1975. Production and Marketing officials report that Alberta will then be the first province to sell vacuum packaged fresh lamb. The carcass will be cut up into legs, loins, racks, shoulders, and various other cuts at the plant. Each cut will be individually packaged in vacuum sealed plastic bags. The traditional way of marketing lamb is by carcass. The new method of vacuum sealing will increase the shelf life of fresh lamb from about eight days to nearly three weeks.

TGA IN POTATOES TGA (total glycoalkaloids) is a normal constituent of potato tubers. In above-normal amounts, TGA gives tubers a bitter taste, and under unfavorable circumstances it may reach a toxic level. A new Agriculture Canada publication, ''TGA In Potatoes'', recommends procedures to control TGA levels in tubers. In addition, the publication provides information on the distribution of TGA in the potato plant, normal TGA levels in various tuber tissues and TGA levels in different varieties of whole tubers.

The publication recommends that if potatoes are thought to contain high levels of TGA, the nearest Fruit and Vegetable Inspector should be consulted before sale or use. Publication 1533 may be obtained from: Information Division, Agriculture Canada, Ottawa, K1A 0C7.

MAUVAIS ENTREPOSAGE DES INOCULANTS Une enquête sur la distribution des inoculants de légumineuses, a démontré que des échantillons prélevés chez le détaillant, soit avant même de parvenir à l'utilisateur, sont stériles et inefficaces.

M. Lucien Bordeleau, microbiologiste à la Station de recherche d'Agriculture Canada à Ste-Foy (Qué.), nous dit: ''On voulait savoir s'il y avait encore, au moment de l'utilisation, un nombre suffisant de bactéries vivantes dans l'inoculant pour noduler les plantes de façon efficace.''

On connait le nombre théorique de bactéries vivantes qui doit se trouver dans l'inoculant appliqué. En comparant ce nombre à celui des nodules qui effectivement se forment sur les racines des plantes, on déduit le nombre réel de bactéries viables présentes au moment de l'inoculation.

Les résultats de ces expériences ont indiqué une perte d'efficacité d'environ 80% des échantillons du Québec. ''De la société fabricante au distributeur final, il n'y a qu'une perte de 5%. Donc 75% de la perte d'efficacité est attribuable au détaillant,'' les fluctuations de températures, gel de la nuit et fortes chaleurs de la journée, font que les bactéries prennent très peu de temps à mourir.''

A l'heure actuelle, il n'existe aucun contrôle, mais M. Bordeleau travaille sur un projet de contrôle de la distribution des inoculants en collaboration avec des techniciens du ministère de l'Agriculture provincial et de l'université Laval de Québec.

PROPAGATING LOWBUSH BLUEBERRIES Propagating lowbush blueberries by rooting stem cuttings is an exacting procedure. In 1974, scientists at the CDA Research Station, Kentville, Nova Scotia set some 660 cuttings of 8 clonal lines in sand and an equal number in a 50:50 mixture of sand and peat for propagation. Rooting success in the sand was 62 percent while in the sand-peat mixture it was 90 percent.

Propagating from dormant hardwood cuttings is advocated by some, but for Drs. Ivan Hall and Lewis Aalders, research scientists at Kentville, it has always been an unsatisfactory procedure. In 1974, they set 100 hardwood cuttings of four clones in a mixture of sand and peat for propagation. In 8 weeks only two cuttings had rooted satisfactorily. According to the scientists, it would appear that propagating lowbush blueberries by softwood cuttings in a mixture of sand and peat is the best procedure at the present.

CIDA AIDS ANIMAL NUTRITION RESEARCH Although grains are now the basis for feeding livestock, there are a number of new possibilities in livestock feeding which indicate the potential of both land and human ingenuity. Revolutionary new technology for developing animal feed based on sugar cane has been developed with the assistance of the Canadian International Development Agency (CIDA). The Cornfith process, as it is known, was evaluated and extended through CIDA to provide feed for increasing animal production in tropical countries. Work under Canadian guidance in the Barbados has shown that the photosynthesizing capacity of the sugar cane plant can be used for the animal industry involving both cattle and pigs.

LEAFLESS PEAS A program has been started at the CDA Research Station, Morden, Man., to transfer the leafless character of peas to Canadian cultivars of field peas. It has been found that a particular combination of specific genes in peas will reduce the leaflets into tendrils and also reduce the size of the stipules. According to Dr. S. T. Ali-Khan, a research scientist at Morden, it is possible to transfer the leafless character to any genetic background in peas by a crossing program. For example, scientists can transfer the leafless character from vining peas to our Canadian cultivars of peas, such as Century.

It has been established that the leafless vining peas are as productive as normal peas. In addition, leafless peas have a better standing ability, mature more uniformly, are less conducive to disease pathogens, are easier to control for pests, are easier and more efficient to spray with herbicides, and will dry faster at harvest time.

THE SHEEP INDUSTRY STEPS FORWARD

L. JAMES

Grâce aux efforts des éleveurs de moutons et à ceux des chercheurs scientifiques d'Agriculture Canada, on remarque des tendances nouvelles et intéressantes dans l'industrie ovine canadienne. Par des programmes de production et de commercialisation, visant à développer et à maintenir une production saine, Agriculture Canada a soutenu l'industrie ovine.

Sheep raising dates back to the beginning of agriculture in Canada. Although the early settlers ate lamb and mutton, their main concern was the production of wool to clothe their families. Over the years, the production of quality lamb carcasses has become the prime consideration with wool of secondary importance.

Traditional methods of lambing in the spring and selling the lambs in the fall are disappearing. Under that system, producers sold most of their lambs within a period of 8 weeks at a low price, leaving a shortage of domestic lamb for the rest of the year. Although 42 percent of Canada's federally inspected sheep and lambs are still slaughtered from September to December, a shift is occurring.

Lois James is an editor-writer, Periodicals Services Unit, Information Division, Ottawa.

It is not uncommon to hear people condemn sheep raising. They say it is a dying industry; and, in fact, the sheep population has declined by 38 percent in the last 10 years. Canada's 783,500 sheep and lambs do not meet consumer demand for lamb and mutton. In 1973, Canada imported 48 million lb of lamb and mutton valued at $29.5 million. Statistics show that when lamb is available, consumers will buy it. In 1972, when 65 million lb of dressed lamb were imported, per capita consumption rose to 4.7 lb, but in 1971 only 43.7 million lb were imported and per capita consumption was 3.3 lb. Increased production is the challenge for the sheep industry.

A New Look

Those who have stayed with sheep and practiced good husbandry state that there are greater returns for investment in sheep than for any other kind of livestock. Some agricultural leaders see sheep production as a major opportunity for producers. Because of the persistence and efforts of these producers and with the support of Agriculture Canada research scientists, several new and interesting trends are developing in the sheep industry.

Some of the ideas that have prompted this 'new look' entail far-reaching modifications of traditional methods: confinement rearing; light control and year-round breeding for lambs; early weaning of lambs for quick re-breeding of ewes; specially formu-

lated rations for the economical maintenance of ewes and maximum growth rate in lambs; and development of a breed demonstrating high economical returns under confinement. Agriculture Canada scientists at the Animal Research Institute, Ottawa, the Research Stations at Lethbridge, Alta., Lennoxville, Que., and Fredericton, N.B. and the Experimental Farms at La Pocatière, Que., and Nappan, N.S., are working on these concepts to develop a sheep production system of practical use in Canada. However, scientists feel that some of the new techniques will only need to be applied in part to improve efficiency of conventional operations.

Marketing—The Key

Sheepmen, industry and governments in Canada agree that the key to the success of an efficient sheep producing industry is the development of a marketing structure and processing industry capable of maximizing returns to the sheep industry as a whole. Various programs have been tried by Agriculture Canada over the last several years[1] to increase the viability of the sheep industry. As these programs did not meet their objective of increasing production, Agriculture Canada in consultation with Canadian sheepmen encouraged the formation of the Canada Sheep Marketing Council (CSMC). Agriculture Canada has agreed to provide $750,000 to the Canada Sheep Marketing Council over a five-year period.

Projects undertaken by the Canada Sheep Marketing Council in 1973-74 were as follows:

- shares in the lamb Processors' Cooperative at Innisfail, Alberta.
- developing lamb recipe booklets featuring fresh Canadian lamb.
- an in-store advertising program with colored posters and display cards showing various cuts of lamb.
- advertising lamb in the ethnic market during the Easter season.
- financing 25 percent of the cost of a feasibility study on a wool-scouring plant.
- better communications within the sheep industry through CSMC information services.
- structuring the provincial organizations to develop strong provincial groups within the present framework.

To permit producers to raise heavier, meatier lambs, Agriculture Canada recently implemented a new lamb carcass grading system. This new system eliminates the previous restrictive weight ranges and introduces a cutability factor which will divide Canada A grade carcasses into four fat levels. Five grades of lamb and mutton have been identified: A, B, C, D and E. Under this system the consumer will be able to identify the quality and fat level of lamb he or she prefers.

[1]Wool Price Stabilization, 1958-1970.

(Top) Traditionally, most lambs are born in the spring. With improved marketing and research this trend may change to provide a steady flow of lamb throughout the year.

(Bottom) Western ewes graze on the rangelands of Alberta.

Improving Production

The Canadian sheep industry only produces about 20 percent of the consumer demand for lamb. Agriculture Canada's Livestock Division, however, feels that the proposed national ROP program that is presently under consideration will help strengthen the Canadian sheep industry's competitive position. National performance data will help both purebred and commercial sheep producers to locate the best producing rams and ewes for their flocks. If the sheep industry is to survive, fast growth rate and high ewe productivity must be the major characteristics of the nation's breeding stock. That will require performance data from present breeds to locate the best parents for genetically superior animals.

If instituted, the computerized ROP for Sheep Testing Program will be a joint federal-provincial program. The program will include the following test data:

- adjusted weight at the end of the test.
- average daily weight gain from weaning to the end of the test.
- end-of-test weight index.
- multiple index (includes multiple birth credit).
- ewe index of lamb production.
- predicted lamb producing value of the ewe.

Optional information will be included for breeders interested in wool recording.

Hans Greiger, head of sheep and swine production in Agriculture Canada's Livestock Division, will be the administrator and coordinator of the ROP for Sheep Testing Program at the national level. He feels that selection of breeding stock on the ROP program will take the guesswork out of production.

Agriculture Canada also provides financial assistance for the transportation, within Canada, of Canadian-bred commercial ewes and ewe lambs. This federal-provincial assistance policy has been responsible for the establishment of larger flocks and the movement of breeding ewes from surplus to deficient areas of production. These ewes have been used extensively for crossbreeding in commercial production.

Research Program

The Sheep Production Program at the Animal Research Institute is developing a system for market lamb production under total confinement conditions. The multi-disciplinary approach includes basic biological research on feeding, breeding, reproduction, and management under total confinement. The development of more suitable breeds through selection and crossbreeding is a major aspect of the program. To achieve high levels of performance for desirable traits (high lambing rates, high growth rate and good muscling of lamb carcasses), exotic breeds of sheep such as the Finnish Landrace, Ile de France and East Friesian have been imported and incorporated into the breeding program.

The breeding flock is maintained in two barns capable of housing 1600 ewes. The lambs are taken from the ewes 8 to 24 hours after birth and moved to a rearing barn where they are fed for 3 to 4 weeks on a milk replacer diet through an automated pipeline system. A fourth barn is used to rear lambs from the time they are removed from the liquid diet to market weight.

The feasibility of lambing every 3 to 3½ months, with a lambing interval per ewe of 6 to 7 months through manipulation of the day-length cycle and other techniques to reduce the time between birth and conception are being explored at the ARI.

At the Lethbridge Research Station three projects are underway on sheep breeding and management. Researchers are measuring the response to selection for weight-per-day-of-age and correlated responses of other production traits. They are also evaluating the genetics and economics of crossbreeding with sheep. In a project on intensive management, out-of-season breeding through estrus induction by light control is being evaluated.

Lambing frequency and number of lambs born per ewe are the main determinants for profitable lamb production. Researchers at the Lennoxville Research Station are presently developing a ewe which will breed and conceive regardless of season. A flock of 800 crossbred ewes with ½ Dorset, ¼ Leicester and ¼ Suffolk breeding are exposed to rams from June to October. Each year the earliest-born ewe lambs are kept to replace the latest lambing ewes. High twinning is also a trait that is being selected for in the Lennoxville flock.

Several projects are underway at the Fredericton Research Station in cooperation with the Nappan Experimental Farm. The energy requirements of intensively managed ewes bred to produce lambs more than once a year are being evaluated. In addition, a feeding trial with lambs was recently com-

(Top) By taking milk from their artificial "mom", these lambs do their best to help scientists develop economical and practical ways of increasing lamb production.

(Bottom) All wool in the grease must be graded prior to export. Agriculture Canada inspectors ensure that all wool for export conforms to quality grades.

(Left) Four Agriculture Canada research scientists hope to develop sheep that will produce at least two lambs per litter—ideally twice a year. The scientists are, left to right, Dr. H. Robertson, Dr. E.E. Lister, Dr. D. Heaney, and Dr. H. Peters.

pleted at Nappan to determine the effect of season (summer vs autumn), shearing vs non-shearing, and a period of restricted feeding vs going on full feed on the feed efficiency of lambs from weaning to market weight. Scientists are also researching feeding and management systems for artificial rearing of lambs with emphasis on non-milk ingredients in milk replacer.

At both Nappan and Fredericton, sheep are used extensively as laboratory ruminants to determine digestibility, relative intake of various feeds, and for studying the effects of changes in feeding practices on the pattern of digestion, absorption, and metabolism of ruminants. These results should apply equally to cattle and sheep.

Work is also being conducted at Nappan in cooperation with the National Research Council on the possible role of soil fungul toxins on the ill-thrift syndrome in lambs.

Wool Production

In 1973, about 50 percent of Canada's 3.2 million lb of wool was exported; imports amounted to 43 million lb. Many sheepmen regard their income from wool as the "gravy". The average farm price for wool in 1973 was about 70¢/lb, although 1974 prices were somewhat lower.

All wool in the grease must be graded prior to export. Agriculture Canada inspectors ensure that all wool for export conforms to quality grades under the Wool Grading Regulations. There are 17 registered wool warehouses in Canada. The largest of the registered operations is the Canadian Cooperative Wool Growers which handles about two-thirds of the annual Canadian clip.

The Systems Approach

The Food Systems Branch of Agriculture Canada has formed a committee of producers, processors, retailers, consumers and government officials to identify program needs and make recommendations for the Canadian sheep and lamb system. Their aim is to develop and maintain a viable Canadian sheep and lamb industry. In order to achieve this, they have identified the following five objectives for the sheep and lamb industry:

- to identify, develop, promote and meet markets for Canadian-produced sheep and lamb.
- to build a production industry.
- to build a processing industry capability.
- to develop a marketing structure.
- to develop and maintain effective communications within the system.

These objectives will form the framework for more specific goals and activities, as identified by the total system, needed to achieve the opportunities. With producer, industry and government support, the Canadian sheep industry may be able to develop to its full potential. ■

INCREASING PRODUCTION FROM RANGELAND

S. SMOLIAK and A. JOHNSTON

La propagation naturelle, la destruction de la végétation compétitive par procédés chimiques suivis d'un semis à la volée, le semis intermédiaire et la propagation artificielle sont les quatre méthodes employées dans l'Ouest du Canada pour augmenter la production de fourrage des grands parcours. Seule la dernière méthode a permis une augmentation substantielle du fourrage.

More forage is required to maintain western Canada's increasing livestock population. The easy methods for increasing the forage supply have been largely exhausted. Future increases will be more difficult and more expensive.

Many methods of increasing the forage supply from rangeland have been attempted in western Canada. These methods include natural revegetation, removal of competing vegetation with chemicals followed by broadcast seeding, interseeding, and artificial revegetation. Of the four methods, only artificial revegetation has resulted in substantial increases in the forage supply.

Natural Vegetation

Conventional range management suggests that depleted ranges should be restored by using improved management provided that sufficient desirable plants remain. Improved management, particularly of grazing, can restore vigor of desirable forage plants, assure adequate seed production and seedling establishment, and accelerate vegetative spread through tillers or rhizomes.

Natural revegetation is cheaper than artificial seeding. Where only adjustments in grazing management are required, the added expense of a natural revegetation program may be little or none. Artificial seeding is generally expensive. In the 1960's, the cost per acre of seedings made in the Brown and Dark Brown soil zones of western Canada varied from $8.80 to $16.50 for breaking, seedbed preparation, seed, and seeding.

According to some ranchers, animals gain better and stay healthier when grazing on the complex mixture of species on rangeland than they do when grazing the apparently monotonous diet of a single species. But there is much evidence that sheep or cattle gain better and stay as healthy on a diet of continuous Russian wildrye pasture, for example, than they do on a diet of continuous native range.

Complex mixtures are thought to be more efficient than simple ones in using all environmental resources. But where the harvest is confined to the leafy portion of grass plants, "niche specialization" is not very important. There is also evidence that, where resources are limiting, they tend to be shared unequally and the yield an acre approximates that of the higher-yielding species in the mixture.

Complex mixtures are more stable than simple ones. Range cover is not usually totally destroyed by drought or winterkill like a single species such as alfalfa.

S. Smoliak and A. Johnston are research scientists at the CDA Research Station, Lethbridge, Alberta.

Interseeding adapted forage species into tilled strips on native rangeland increased forage yield by about 9 percent.

Where the environment is controlled, high production of seeded stands is likely to be associated with simple mixtures containing few species. Stability is the main advantage for the complex mixtures in native range. At one time, the advantage of native range was in low cost grazing. But, because of rapidly appreciating land values, this no longer applies in the range areas of western Canada.

Zero Tillage

Minimum or zero tillage became feasible when chemicals were introduced in the 1950's. These could destroy existing vegetation with little or no residual effect on the crop being established. This method of rangeland renovation has been very effective on roughland pastures in Ontario where a herbicide, phosphate fertilizer, and birdsfoot trefoil seed were broadcast together. Tests on southwestern Alberta foothills range, involving the application of a herbicide, phosphate fertilizer, and alfalfa, sainfoin, or cicer milkvetch seed, were not effective. This was due to lower precipitation in southern Alberta than in Ontario. Removal of competing vegetation with a chemical followed by broadcast seeding, therefore, cannot be recommended in areas of low rainfall.

Interseeding

Low cost seeding methods with partial tillage have been designed where species can be introduced into rangeland without complete seedbed preparation. One such range improvement method is known as "interseeding". It was designed to retain the advantages of both native range and seeded stands. The method involves cultivating 1-ft strips at 3-ft intervals across a range and seeding an adapted forage species into the cultivated strip. The resulting stand consists of rows of the introduced species at 3-ft intervals with a 2-ft strip of native vegetation between the rows.

Yield increases have been obtained as a result of interseeding. However, increases resulted from the release of nitrogen due to the breakdown of organic matter in the sod removed from the cultivated strip rather than from the mixture of native and introduced species. Interseeded areas produced 360 lb/ac of dry matter compared to 330 lb/ac from the untreated range, an increase of 9 percent.

Complete tillage and then seeding adapted forage species increased the forage yield by 100 percent.

Artificial Revegetation

Conventional range management suggests that only where insufficient desirable forage plants remain should consideration be given to artificial revegetation. We believe that this is an oversimplification. Artificial revegetation involves destruction of the remaining native cover and complete preparation of a seedbed followed by drilling of seed of a cultivated forage species.

Higher production from seeded stands than from native stands has been clearly demonstrated in grazing trials at the Research Substation, Manyberries, Alberta. In the first trial, we grazed yearling ewes on crested wheatgrass, Russian wildrye, and native range continuously, in rotation, or free-choice. Under continuous use, the yearling ewes gained 26 lb/ac on Russian wildrye and 22 lb/ac on crested wheatgrass or 3.2 and 2.6 times the gain on native range (8 lb/ac). The rotation produced 16 lb/ac gain while the free-choice system of grazing produced 18 lb/ac. When crested wheatgrass was used as a spring pasture, native range as summer pasture, and Russian wildrye as fall pasture, it was possible to extend the grazing period during which the ewes gained or maintained their weight to 7½ months. The introduced grasses produced twice as much dry matter an acre and could be grazed three times more heavily than native range.

In the second trial, we grazed yearling steers on the three pasture types. The steers on the continuously grazed Russian wildrye pasture gained 96 lb/ac or 6 times the gain of 16 lb/ac on native range over a 6-month period. When crested wheatgrass, native range, and Russian wildrye were grazed in rotation or free-choice the acreage requirement was reduced by 50 percent, compared with that required on native range, and beef production per acre was increased by 60 percent.

Beef production can be increased through the use of seeded pastures. The forage resources, however, must be developed before livestock increases are made. The availability of forage and the numbers of cattle must be balanced to assure sustained production. ■

HOTTER HOSPITAL FARE FROM FROZEN FOODS

J. A. KITSON and J. F. BOWEN

Les scientifiques de Summerland en Colombie-Britannique ont aidé un hôpital régional à mettre au point un système de préparation des aliments dans lequel des repas complets sont préparés et congelés. Ils sont ensuite chauffés quelques minutes avant de servir. Les repas étaient chauds, appétissants, nutritifs et remarquablement exempts de bactéries. C'est un avantage induscutable par rapport à la table chauffante.

A common complaint among hospital patients is that the food is cold and lacks flavor by the time it is served. To ensure that hospital food is both hot and tasty when served, the staff of the Food Processing Section at Summerland recently finished eating their way through 2 weeks of menus from nearby Penticton Regional Hospital. During more than 2 months of daily taste panels, we evaluated 100 samples of everything from soups to desserts. At the same time, we carried out 276 bacteriological examinations to ensure safety of raw materials and cooked foods.

The evaluations performed at Summerland were Agriculture Canada's part of a joint project carried out under a National Health and Welfare grant. This grant was given to develop an improved system for preparing and serving hospital foods.

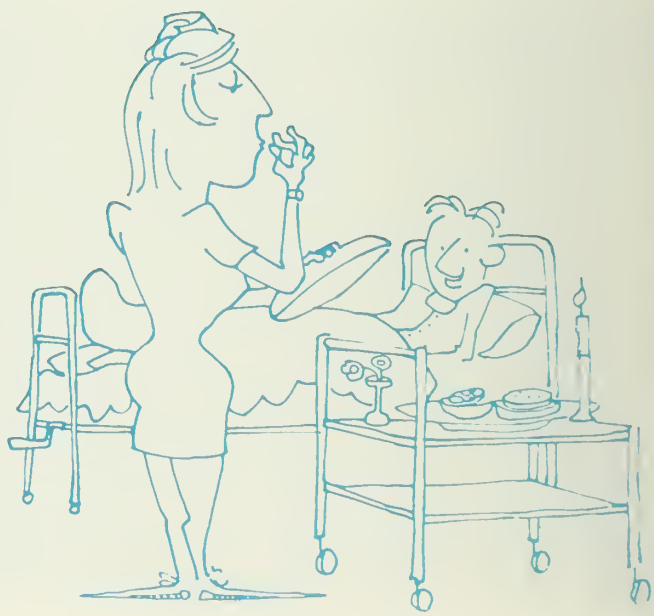
Under the supervision of project director, June Palmer, over 100 new or modified recipes were developed at Penticton Regional Hospital. The most important recipe specification was that the foods should not break down during freezing and thawing. Test samples were prepared in the hospital kitchen, packaged in 12 portion servings in disposable aluminum steam table pans and frozen. The samples were thawed for 48 hours in a cool room at 38°F. About 2½ hours before serving time the thawed foods were moved 12 miles to the Research Station in insulated boxes.

Immediately upon arrival in the Food Processing Section, the chilled foods were weighed onto heavy china serving dishes and covered with aluminum foil. These dishes were also chilled to 38°F before loading in order to keep the food temperature below 40°F until final heating was begun. After filling, the plates were returned to a 38°F cool room until approximately 30 minutes before serving time.

In the hospital the final heating of the meals is carried out in forced air convection ovens located in the ward galleys. Each oven can heat up to 24 servings in 20 minutes when operated at 300°F. One of the ovens was set up in the Research Station test kitchen, thus enabling us to reproduce heating conditions in the hospital.

On 30 selected samples, electronic temperature sensors were inserted into the center of the thickest and presumably slowest heating item on the plate. Food temperatures were measured during the 20 minute heating period and for the first 10 minutes after the dishes were removed from the oven. During the 10 minute holding period we found that the temperatures continued to rise and all samples reached a satisfactory serving temperature. Since 10 minutes represents the maximum time required in the hospital to move the meals from the ward galleys to the patients, this ensures that the food is served at maximum temperature.

Samples were judged by a six to ten member trained panel composed of Food Processing Section staff members at Summerland. The dishes for taste panel evaluation were heated at the same time as those used for heating rate measurements. Panelists assessed from one to four menu items daily at a single session. Factors considered in scoring were



Mr. Kitson is a food processing specialist and Dr. Bowen is a specialist in food microbiology at the CDA Research Station, Summerland, B.C.

appearance, color, flavor, texture and suitability of serving temperature. The tasters used a descriptive rating system to classify samples into nine categories ranging from category 9, 'like extremely', to category 1, 'dislike extremely'. The few items with ratings below category 6, 'like slightly', were improved by changes in ingredients and cooking methods then resubmitted for a second evaluation by our panel. When the improved samples were resubmitted to the panel they were all classified in category 6 or better.

As well as ensuring that hospital meals are hot, good tasting and attractive in appearance, we found that the new food-serving system helps maintain the natural nutritive value of the foods. For example, holding broccoli on a conventional cafeteria steam table for one hour causes a Vitamin C loss of 68 percent. By contrast, reheating in the convection oven and serving within 10 minutes resulted in a 27 percent loss. This figure is comparable with the best home-cooking methods.

A further benefit of the new food system arose during a recent labor dispute in the western Canadian meat packing industry. Although meat supplies were temporarily cut off to Penticton Regional Hospital, the menu schedule was maintained without change because a month's supply of meat-based items was already in the freezer.

In a food system such as this, it is essential that bacterial contamination be held to a minimum. Therefore, good, sanitary food-handling methods were followed at all stages of the program. Samples collected at the point of service (the ward galleys) were analyzed for total bacterial count to ensure this. Because no official microbiological standards exist, as yet, for foods prepared in this, or any other system, arbitrary limits were selected by the Summerland scientists. The upper limit for this food preparation system was set at 50 percent of that occurring in regular pre-cooked frozen foods and the early-warning level was 50 percent of that.

Samples of both basic ingredients and complete menu items were collected, sealed into sterile plastic pouches, frozen, and stored at −26°C until analyzed. On arrival at the laboratory, they were thawed overnight in the refrigerator or for a shorter time at room temperature. A weighed quantity of sample was mixed in sterile water and plated on standard plate count agar for total count or dispensed into tubes of thioglycollate broth for the detection of anaerobic bacteria. The botulism organism is in this second group.

The prepared foods were divided into a number of categories for analysis of the test results. These were as follows: meat, fish, poultry, whole, comminuted and creamed; vegetables, whole, creamed and casseroled, uncooked egg and milk beverages, and cooked egg dishes; cream puddings and sauces; soups and meat sauces; salads; sugar based sauces;

Foods were covered with aluminum foil prior to heating in forced air convection ovens.

and bread and cakes. Basic ingredients were milk, powdered starch and spices.

Results showed that there were no anaerobic bacteria present, and therefore the likelihood of botulism was quite remote.

The uncooked items, salads and egg-milk beverages, had, in some cases, quite high bacterial counts. We concluded that these reflected the bacterial quality of the materials used and recommended that care in the selection of basic ingredients would eliminate the problem of high bacterial content.

The creamed meat, poultry, fish and vegetable dishes had very low counts. This showed that preparations of this sort, so often implicated in outbreaks of food poisoning at public functions, can be completely safe if good sanitary methods of preparation are maintained.

Cooked whole meats, vegetables and soups all were well below the set upper limit. In some cases, ground meats of the hamburger type were slightly higher. These had been supplied from commercial sources as frozen patties and this could have been the source of the contamination.

Commercial spices varied quite widely. As it is possible to purchase dry sterilized powdered spice, these should not cause problems.

Milk and starch were low with one exception. One sample of milk showed an undesirably high count. Again, care in selection of raw ingredients should eliminate any problems.

We concluded from these results that when basic ingredients are chosen with care, and good, sanitary methods of preparation are observed, the system of food distribution will provide safe, wholesome and appetizing meals. ■

THE PROTEIN QUALITY OF FABABEAN CULTIVARS

A fababean plant in late summer.

M. S. KALDY and D. B. WILSON

Grâce à sa teneur en protéine de 28 à 30%, la fève des marais pourrait participer à satisfaire la demande, tant humaine qu'animale, du Canada. Les chercheurs de la Station de recherche de Lethbridge étudient, parmi d'autres sources, les possibilités de la fève des marais comme source importante de protéine.

At the Lethbridge Research Station we are examining fababeans (*Vicia faba* L. var. *minor*), amongst other crops, for the possibility of building a major protein source into a single crop. Such a crop would help to meet Canadian needs for livestock and human food and might also be of great benefit to people in less developed, protein-deficient countries.

The fababean was recently introduced into Canada from Europe. It is a leguminous crop with a large edible seed and, as such, belongs to the group of plants knows as the pulses. It is well adapted to the climate of western Canada and has produced, in some years and locations, high yields of beans both in experimental plots and in farm fields. Some people look upon it as western Canada's answer to the soybean.

Dr. Kaldy is a food scientist and Dr. Wilson is Head of the Plant Science Section, CDA Research Station, Lethbridge, Alberta.

With a protein content of 28-30 percent, fababeans could contribute to the protein needs of both man and animals. Unfortunately, the amino acid composition of fababean protein is not well balanced. Its lysine content is very good, far superior to that of cereal grains, but its methionine content is low. Ruminant animals are able to synthesize all of the amino acids and can make good use of the high protein content of fababeans. In man and other monogastric animals, some of the amino acids are synthesized in the body, but there are eight that must be supplied in the diet. The eight are called the essential amino acids and the quantity of them present determines the nutritional value of the protein. Both lysine and methionine are essential amino acids.

In our society, the nutritional quality of plant protein can be increased by supplementation. This occurs by eating a variety of plant and animal products, or by adding manufactured amino acids to the food. In this way, fababeans can be a useful food for man and monogastric animals such as hogs.

TABLE 1 PROTEIN SCORES OF EIGHT FABABEAN CULTIVARS COMPARED TO CORN, WHEAT, AND SOYBEAN[1]

	Essential amino acid							
	Aromatic[2]	Isoleucine	Leucine	Lysine	Sulphur containing[3]	Threonine	Tryptophan	Valine
Fababeans								
Ed Hoff	102	92	131	148	41	95	98	74
Erfordia	103	91	131	148	41	93	91	75
Freya	102	92	134	146	36	92	99	77
Fribo	102	93	133	146	40	91	97	77
Kleinkornige	102	92	136	146	36	92	90	77
Maris Bead	105	91	134	145	37	91	100	76
Primus	101	90	132	148	46	95	80	76
Schaldener	102	91	132	147	46	94	79	74
Average	102	92	133	147	40	93	92	76
Corn[4]	111	71	181	53	80	90	57	86
Wheat								
Whole grain	121	80	122	72	88	93	111	99
Flour	120	92	133	54	88	88	113	95
Soybean	106	90	115	130	60	99	105	87
Egg	100	100	100	100	100	100	100	100

[1]Based on the reference pattern of FAO/WHO report (FAO, No. 37, 1965). The lowest values represent the "protein scores" (shown in italics).
[2]Phenylalanine + tyrosine.
[3]Methionine + half cystine.
[4]Protein scores for corn, wheat, and soybean calculated from FAO Nutritional Studies No. 24, 1974.

A fababean pod shortly before harvest.

In the less developed countries, the opportunity for supplementation may be limited because fewer food choices are available. In this case, breeding and selecting for improved protein quality in the main item of the diet offers good possibilities for better nutrition.

In our investigations at Lethbridge, eight cultivars of fababeans (Ed Hoff, Erfordia, Freya, Fribo, Kleinkornige, Maris Bead, Primus, and Schaldener) were studied for amino acid composition. The results were converted to protein scores, which give a good estimate of protein quality. Scores for the various cultivars varied from 36 to 46 with an average of 40 (Table 1). Ideal protein, which is represented by egg, has a score of 100. In comparison, corn has a score of 53, whole grain wheat 72, wheat flour 54, and soybean 60.

Cultivars Primus and Schaldener had the highest scores, 46, in the sulphur-containing amino acids (methionine and cystine). Cystine is not an essential amino acid but it can substitute, in part, for methionine. Tyrosine has a similar action for phenylalanine. It remains to be seen if lines with higher protein scores can be found. If they are, a breeding program to develop fababeans with better protein quality may be started. Our present screening program is directed toward this goal. ■

A WARNING SYSTEM FOR PESTS IN APPLE ORCHARDS

ROBERT TROTTIER

La mise au point d'indices bioclimatiques et l'amélioration des techniques de surveillance permettent l'amélioration des pratiques de gestion des vergers de pommes du Québec et de l'Ontario.

Les chercheurs de la Station de Vineland ont effectué des études dans différentes régions de l'Ontario et peuvent maintenant prédire avec précision l'éclosion des œufs de la tétranique rouge des pommiers et de la pyrale de la pomme ainsi que l'envol de la mouche de la pomme et de la pyrale du pommier dans ces régions.

The development of successful pest management programs in apple orchards is often limited by the lack of predictive bioclimatic indices and reliable monitoring methods for assessing pest numbers and indicating the need for pesticide applications. This is of particular importance in geographic regions where pest pressures are influenced by regional climate. In the Georgian Bay area of Ontario, in eastern Ontario and in most regions of Quebec, a second generation of codling moth rarely occurs, while in southern Ontario and the southern-most, apple-growing areas of Quebec two generations frequently occur. In these areas, the need for pesticide application must be determined locally if effective management programs are to be developed and implemented.

In the past 4 years, studies have been undertaken at the Vineland Research Station to develop indices and improve monitoring methods necessary for the implementation of total pest management programs. Considerable progress towards this goal has been accomplished. We have developed time-temperature indices relating insect pest development to the microclimate in apple orchards. From 1971-74, we conducted studies in different apple growing areas of Ontario and can now accurately predict the hatching of European red mite and codling moth eggs, and the emergence of apple maggot and codling moth in these regions.

European Red Mite

Hatching of the overwintering eggs of European red mite occurs in late April and early May. The date of the first hatch varies considerably from year to year and cannot be precisely related to the phenological development of the apple tree. Therefore, accurately timing a pre-bloom spray based on a phenological index is difficult for most apple orchards of Ontario. Furthermore, it is difficult and time consuming to estimate the time of the first or 50 percent hatch by sampling or visual observations. By estab-

Dr. Trottier is an ecologist at the CDA Research Station, Vineland, Ontario.

lishing the temperature threshold of development (5.6 °C) under constant and fluctuating temperatures in the laboratory, and by developing a modified method to estimate degree-days for hatching (155 dd) in the field, it is now possible to predict, within one day, the first hatch in the different climatic regions of Ontario.

Codling Moth and Apple Maggot

The timing of insecticide applications for control of the codling moth and apple maggot in pest management orchards is currently based on pheromone and bait trap catches of adults, frequent visual inspections of trees and observations of pest development. However, the interpretation of trap catch data relative to potential pest damage is not yet possible. There is a need for additional indices to supplement current monitoring techniques.

As a first step in this direction, in our laboratory we found that the temperature thresholds of development for both species was 11 °C for the codling moth and 9 °C for the apple maggot. Predicting first significant catch was accomplished in the field by studying the relationship between the microclimate of the apple tree and air temperature in Stevenson screen. A total of 110 dd and 425 dd was found for the two species, respectively. This method is sufficiently reliable to predict within 2 days the first catch of codling moth and apple maggot. This information is valuable to growers who base much of their decision to spray on first emergence. Furthermore, the first hatch of codling moth eggs can be related to accumulations of 100 dd above 11 °C from the first significant catch in pheromone traps and the seasonal maximum activity of apple maggot to 800 dd above 9 °C from April 1.

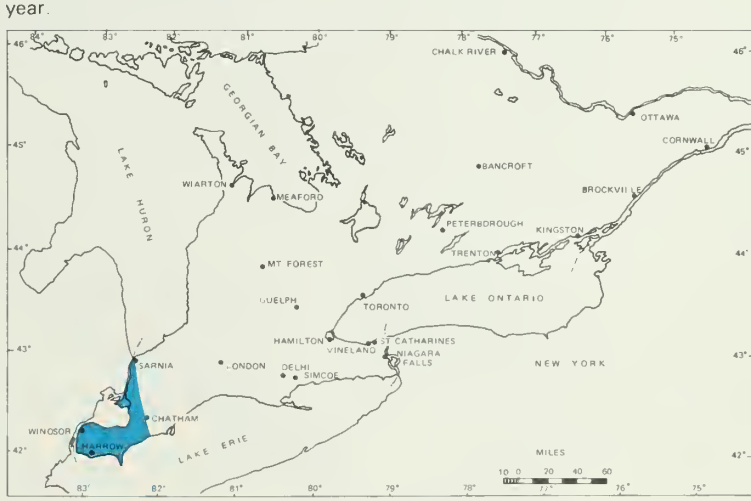
The ability to predict the occurrence of second-generation codling moth is being tested in the field by using an index based on the mean temperature of July (Table 1). This index and the prediction of late apple maggot activity by degree-day summations will assist in optimizing the timing of late-season sprays in Ontario apple orchards.

Although a modified four-spray program for apple orchards in Ontario has been developed, implementation of such a program will be limited until a total, pest-warning network is established. The development of bioclimatic indices and better monitoring techniques will assist in implementing pest management practices throughout Ontario and Quebec. However, it is essential that data on pest populations from the climatic areas of Ontario and Quebec together with weather observations be gathered, analysed and disseminated from a central location. Only then, can a total warning system for pest management in apple orchards be developed and implemented that will be economical for the grower and the industry. ■

Probable occurrence of second generation codling moth in a warm year.

Probable occurrence of second generation codling moth in a normal year.

Probable occurrence of second generation codling moth in a cold year.



THE EFFECTS OF SEEDING DEPTH ON SPRING WHEAT PRODUCTION

C. H. ANDERSON

La profondeur des semis du blé de printemps est un facteur important pour maximiser la production. Les chercheurs de la Station de recherche de Swift Current, ont découvert que pour les trois variétés: Manitou, Thatcher et Chinook, la production était la plus élevée pour un semis à 2 po (5,0 cm) que pour un semis à 1 po (2,5 cm) ou que pour un semis à 4 po (10,0 cm).

It is generally agreed that accurate seed placement is one of the most important factors in maximizing crop production. Wheat is generally sown only deep enough to place the seed in moist soil that will be adequate for normal germination of the seed and establishment of the young plant. In subhumid and humid climates, most of the wheat is sown at depths of 2.5 to 7.6 cm (1 to 3 in.). In semiarid and arid climates it is often necessary to sow at depths of 5.0 to 10.2 cm (2 to 4 in.) in order to place the seed in moist soil. Extreme sowing depths are undesirable. However, as the major part of the food reserves of the endosperm is used up in developing the long rhizome and coleoptile development of the roots and leaves is retarded. This problem may be solved by using hoe press or deep furrow drills that open furrows and place the seed into moisture while providing a shallow soil covering in the bottom of the furrows.

In areas of the prairies where discers are used for seeding wheat, uneven germination, delayed emergence, poor color and unthrifty plants are not uncommon. These plants have often emerged from a depth of 10 cm (4 in.) or more in loose soil. Some producers have suggested that spring wheat varieties differ in their response to seeding depth.

In order to investigate these claims, a study was initiated in 1970 at the Research Station, Swift Current, Saskatchewan. Three varieties of spring wheat, Manitou, Thatcher and Chinook were sown on Wood Mountain clay loam soil at depths of 2.5, 5.1, 7.6, and 10.2 cm (1, 2, 3 and 4 in.). Treatments were replicated six times in a split-plot design. Seeding was carried out with a one-row, hand-operated, V-belt seeder equipped with a shoe-type opener. Plots consisted of four rows spaced 22.9 cm (9 in.) apart and 5.0 m (16 ft) in length. Accurate placement of seed was provided by measuring from the bottom of the two forward seeder wheels to the heel of the opener from where the seed was dispensed. The packing action of the third and rear wheel on the seeded row ensured exact depth placement of the seed.

Over the 4-year period, 1970 to 1973, the three varieties were compared at the four seeding depths on the basis of number of plants and number of heads per 3 m (9.8 ft) of row, length of subcoronal internode, yield and volume weight (Table 1).

The data clearly demonstrate that the 5.1 cm (2 in.) depth of planting for all three varieties was superior to the shallow (2.5 cm) (1 in.) and the deeper planting (10.2 cm) (4 in.) in number of mature plants, the number of producing heads and in the final yield. Similarily, the 5.1 cm (2 in.) depth of planting was superior to the 7.6 cm (3 in.) planting of the variety Thatcher. With both Manitou and Chinook the 5.1 cm (2 in.) depth of planting was superior to the 7.6 cm (3 in.) depth in yield, but not in the number of mature plants or heads. The reduction in number of plants and the grain yield agree with previous reports that at depths less than 3.8 cm (1.5 in.), the soil is often too dry for good germination and stands may be reduced.

Volume weight was not materially influenced by seeding depth, but varietal differences were apparent. The length of the subcoronal internodes reflected the different planting depths. The three varieties, however, reacted similarly to the depth of seed placement. It has been reported previously that the variety Thatcher has a short subcrown internode, while Chinook has a subcrown internode of intermediate length. These differences between Thatcher and Chinook were verified in this experiment. The variety Manitou resembled Thatcher. ■

TABLE 1 DEPTH OF SEEDING SPRING WHEAT, (4-yr mean, 1970-73)

Variety	Depth of seeding (cm)	No. of plants/3 m of row	Length of subcoronal internode (mm)	Yield (kg/ha)	Yield as percent of 5.1-cm depth (%)
Manitou	2.5	99	14	1564	94
	5.1	109	25	1671	100
	7.6	111	43	1499	90
	10.2	86	60	1297	78
Thatcher	2.5	90	14	1457	91
	5.1	96	25	1596	100
	7.6	93	44	1377	86
	10.2	82	59	1202	75
Chinook	2.5	91	15	1382	96
	5.1	100	29	1442	100
	7.6	101	50	1332	92
	10.2	90	68	1139	79

C. H. Anderson is Head of Cereal Production and Utilization, CDA Research Station, Swift Current, Saskatchewan.

S. R. LOSCHIAVO

DETECTING INSECTS IN GRAIN-FILLED BOXCARS

Le Canada veut des céréales de haute qualité ce qui signifie entre autre, l'absence d'insectes. Les chercheurs de la Station de recherche de Winnipeg ont mis au point deux trappes très sensibles pour déceler et emprisonner les insectes des wagons à grain.

La grande quantité d'insectes se nourrissant de moisissures indique que les conditions d'entreposage dans quelques élévateurs et quelques fermes laissent à désirer. De meilleures installations d'entreposage et l'amélioration de l'hygiène des bâtiments devrait réduire les infestations du transport.

A primary objective of those involved in grain production and handling in Canada is to preserve the high quality of export and domestic grain. One of the determinants of quality is the absence of insects associated with grain.

These insects can occur in grain at all stages of storage and handling from the farm to the ocean-going vessel. One of the important links in this chain of grain movement is the boxcar that carries grain from the country elevator to the terminal elevator. Small samples are removed during the unloading operation and examined by grain inspectors for quality and the presence of infestation. The probability of detection by this method is not high, particularly in a lightly infested car. Therefore, a modified pitfall trap was designed for use in boxcars.

We soldered a metal lid from a 340 ml glass or plastic jar to a piece of brass sheeting 15 cm^2, perforated with holes 2 mm in diameter. Before soldering,

Dr. Loschiavo is a research scientist specializing in stored products entomology, CDA Research Station, Winnipeg, Manitoba.

we punched a hole, 6.5 cm in diameter, in the lid. This assembly was lowered into a hole bored through the deck of the boxcar to fit flush with the floor and secured with nails. The container was screwed into the lid from below the car.

In 1972 and 1973, two of these traps were installed in each of 5 and 25 cars, respectively, loaned by the Canadian National Railways to test the feasibility of detecting insects in grain during transit. In the 1973 experiment, special markings on the cars were used to facilitate car location on the track upon arrival at a terminal. Instructions inside the car requested elevator agents to unscrew the jar, sweep out the car, and replace the jar before loading. In the 1973 experiment, an insertion-type trap that had been developed at the Winnipeg Research Station, was fastened to the end-wall of the car.

The rail company's tracing service and the Canadian Grain Commission telex service were utilized to help locate cars. Upon a car's arrival at a terminal elevator a grain sanitation officer or grain inspector removed the traps and forwarded the contents, together with appropriate information, to the Winnipeg Research Station. The kinds and numbers of insects, origin and destination of carloads, kind and moisture content of grain, time in transit, distribution of cars in the three Prairie Provinces and the number of trips per car were recorded and programmed for computer analysis.

(Above) Details of trap installation and markings in boxcars. 1. Overall view of car. Note circle painted on placard board; 2. Collecting container being placed in position from below deck; 3. View from below deck of container in position; 4. View from interior of car of surface and location of trap; 5. Insertion-type trap fastened to interior end-wall.
(Opposite) Insertion-type trap. A, assembled and B, disassembled, show the collection chamber.

In the 1972 experiment, 22 percent of the carloads intercepted at the terminals were infested with rusty grain beetles or fungus beetles. These infestations were not detected by any other method of sampling. The presence of insects in the first trip of two of the completely refitted cars indicates that the source of infestation was the grain loaded into the cars. In two cars no insects were found until the third trip, and in three cars none were found after the first trip. If residual populations had been present, they would have been detected more frequently. Most of the wooden linings had been removed to eliminate areas where grain could accumulate and become sources of infestation. No insects were found after mid-September, presumably because most of the shipments were newly harvested crop which was not likely to be infested. If the cars had contained infested residual grain, insects would have been detected at about the same frequency throughout the shipping season. Nevertheless, reports of insects from grain residues in boxcars, particularly those with liners and floors full of cracks and crevices, indicate the necessity of thorough cleaning of cars before each loading.

In the 1973 experiment, 72 percent of 148 carloads of grain delivered in 25 cars from May to October was infested with one or more kinds of insects. During this period, 20 percent and 63 percent of the loads contained rusty grain beetles and fungus beetles, respectively. Other fungus feeding insects were found in 35 percent of the loads. The presence of fungus beetles and other fungus feeders indicates that the grain was damp, or was stored in a facility where moisture could enter. Other stored products insects, for example, flour beetles, dermestids, and saw-toothed grain beetles were found in 7 percent of the loads.

Significantly more insects were found in floor traps than in insertion-type traps surrounded by grain at one end of the car. These larger catches were probably due to one or more of the following factors:

- Rocking of the car during transit creates a sifting action.
- Sliding of grain along the floor during automatic or manual unloading increases the probability of trapping.
- Some insects are positively geotactic and move downward in a bulk of grain.

Of the 432 samples from traps in the cars, 40 percent was infested. Eight percent, 31 percent and 15 percent were infested with rusty grain beetles, fungus beetles, or other fungus feeders, respectively. The mean number of insects per sample was 1.2 and ranged from zero to about seven. Nearly 28 percent of the 148 carloads and 61 percent of the 432 samples were uninfested, while 26 percent and 24 percent of the carloads and samples, respectively contained between one and two insects.

A carload or sample containing even one insect was rated as infested. Thus, the apparently high percentage infestations do not mean that Canadian grain is heavily infested, but rather reflect the high sensitivity of the traps in detecting low levels of infestation. Of the 148 carloads only one was found to be infested on the basis of the official unload sample.

Statistical evidence showed that infestations found in any given carload originated in that load rather than in a previous one.

In conclusion, a highly sensitive and reliable device has been developed to detect and trap insects in grain during transit. The high percentage of fungus-feeding insects found in traps indicates inadequate storage facilities at some farms and country elevators. Improved storage facilities and sound sanitation procedures at the farm and country elevator would reduce infestations in the transportation system and terminal elevators. ■

INFORMATION
Edifice Sir John Carling Building
930 Carling Avenue
Ottawa, Ontario
K1A 0C7

Canada Post Postage paid
Postes Canada Port payé
Third class
Troisième classe
K1A 0C5
Ottawa

IF UNDELIVERED, RETURN TO SENDER
EN CAS DE NON-LIVRAISON, RETOURNER À L'EXPÉDITEUR

Beauregard Press Limited
Contract No.: OKX 3-2333

© Information Canada Ottawa, 1975